IBM @server

IBM

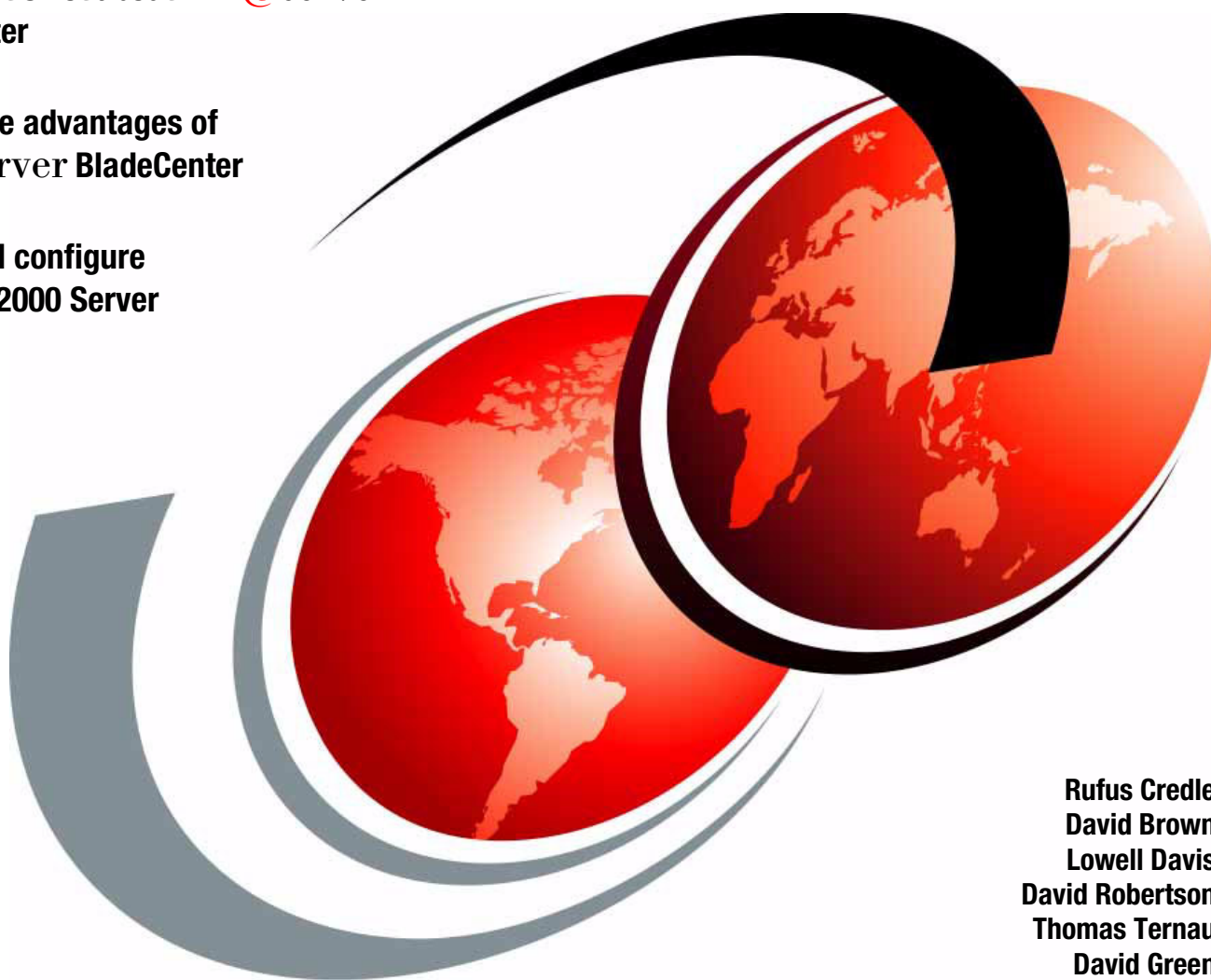# The Cutting Edge:
IBM @server BladeCenter

Learn what's hot about IBM @server BladeCenter

Explore the advantages of IBM @server BladeCenter

Install and configure Windows 2000 Server

Rufus Credle
David Brown
Lowell Davis
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International Technical Support Organization

The Cutting Edge: IBM *@*server **BladeCenter**

November 2003

Second Edition (November 2003)

This edition applies to IBM @server BladeCenter (8677-1xx) and IBM @server BladeCenter HS20 (8678-21x and 8678-41x).

Contents

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Preface

In this Redpaper, we provide an introduction to the IBM @server BladeCenter™. This introduction include an overview of the BladeCenter technology and hardware, for the chassis and the blades. In addition, we take a look at blade management and the options that are currently available. This Redpaper presents the advantages of blade servers over other servers in the market, where the blade servers fit into the market, and why the market is driven towards blade servers. We also look at the various installation methods that are available and what important considerations should be made before you perform your installation. Several installation examples are provided using Windows® 2000 with CD-ROM, RIS and RDM.

Please note that in this document we use the terms HS20, blade server, and blades interchangeably.

The team that wrote this Redpaper

This Redpaper was produced by a team of specialists from around the world working at the International Technical Support Organization, Raleigh Center.

The team, left to right: (standing) Rufus Credle, Lowell Davis, David Robertson, (seated) Thomas Ternau and David Brown

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Summary of changes

This section describes the technical changes made in this edition of the Redpaper and in previous editions. This edition may also include minor corrections and editorial changes that are not identified.

Summary of Changes
for The Cutting Edge: IBM @server BladeCenter
as created or updated on November 24, 2003.

November 2003, Second Edition

This revision reflects the addition, deletion, or modification of new and changed information described below.

New information
- ► Added 1.2.7, "BladeCenter Layer 2-7 GbE Switch Module" on page 12
- ► Added Chapter 5, "A brief introduction to Layer 4-7 Switching" on page 47
- ► Added information to 1.2.4 "BladeCenter 1200W Power Supply Module"
- ► Added URLs to the bibliography

Changed information
- ► None at this time.

1

The cutting edge: IBM eServer BladeCenter

In this chapter, we introduce the IBM @server BladeCenter, which includes an overview of the BladeCenter technology and hardware for the chassis and the blades.

1.1 Introduction to blade server technology

Blade servers are a relatively new technology that has captured industry focus because of its modular design, which can reduce cost with a more efficient use of valuable floor space, and its simplified management, which can help to speed up such tasks as deploying, reprovisioning, updating, and troubleshooting hundreds of blade servers. All this can be done remotely with one graphical console using IBM Director systems management tools. In addition, blade servers provide improved performance by doubling current rack density. By integrating resources and sharing key components, not only will costs be reduced but also availability will be increased.

1.1.1 BladeCenter and BladeCenter HS20 features

In this section, we list the key features of the IBM @server BladeCenter and the BladeCenter HS20 servers.

The IBM @server BladeCenter offers the following:

► Rack-optimized, 7U modular design enclosure, which holds up to 14 hot-swap BladeCenter HS20 blades with up to six enclosures in a 42U rack.

► Contains a high availability MidPlane supporting the hot-swap of individual blades.

► Two 1200-watt, hot-swap power modules and support for two optional 1200-watt power modules, which provides redundancy and power for robust configurations. See guidelines in 1.2.4, "BladeCenter 1200W Power Supply Module" on page 9.

► Two hot-swap 325 CFM blowers and thermal sensors throughout to monitor and alert over-temperature conditions.

► Management module, which lets you manage and control components in the enclosure.

1

- ► Optional hot-swap redundant Ethernet and Fibre Channel switch modules, which supports up to four network switch modules.
- ► Control panel that contains USB port and status LEDs.

The IBM @server BladeCenter HS20 features include the following:

- ► Choose between 2.0 or 2.4 GHz(1) Xeon processors with quad-pumped 400 MHz front-side bus (FSB) and full-speed 512 KB ECC L2 caches.
- ► Standard 512 MB system memory with Chipkill™ ECC support, which supports 8 GB maximum, when 2 GB memory module becomes available.
- ► Dual Broadcom Gigabit Ethernet controllers with teaming and failover support.
- ► Integrated service processor, which monitors critical components on each blade for remote and local systems management.
- ► ATA-100 IDE controller, which provides an economical interface for up to two optional 40 GB IDE HDDs.
- ► SCSI expansion connector, which supports optional storage unit containing an Ultra320 RAID 1 SCSI controller and backplane support for two hot-swap HDDs.

These features are discussed in greater detail in this Redpaper, along with a few other important points.

1.2 Technical overview

In this section, we look at each of the key components individually and explain their function within the IBM @server BladeCenter and the BladeCenter HS20.

1.2.1 BladeCenter chassis

The IBM @server BladeCenter is a 7U modular chassis that is capable of housing up to 14 blade servers. The BladeCenter chassis allows individual blades to share resources such as power, switch, management and blower modules. The front view of the BladeCenter chassis is shown in Figure 1-1 on page 3. From this we can see the 14 slots which, in this example, have been populated by one blade server and 13 Processor Blade Fillers. These Processor Blade Fillers are required if a slot is not populated by a blade server or the HS20 SCSI Expansion Option, which is discussed later, to provide proper airflow and system cooling. The BladeCenter Media Tray is also shown; it is located at the top of the chassis above the blade slots. This is shown in greater detail in Figure 1-2 on page 4.

Figure 1-1   Front view of BladeCenter chassis

The Media Tray is a hot-pluggable unit that contains an interface card, CD-ROM, and diskette drive. Mounted on the interface card is a USB 1.1 port and system information LEDs, which provide status information for your IBM @server BladeCenter and BladeCenter HS20s.

There are five LEDs on the front panel. Figure 1-2 on page 4 illustrates the location of these LEDs. The five LEDs are:

Power   This is a green LED that indicates the presence of power in the BladeCenter chassis. If this LED is not on, it could indicate one of the following conditions:

- There may be no power to the chassis
- The Management Module is not present or has failed
- The LED has failed

Location   This LED is used to locate or identify the particular IBM @server BladeCenter. When on, this LED is bright blue and can be set to blink or remain constant. This LED will be on as a result of a request from the systems administrator via the Management Module or if a component requires maintenance.

Over- temperature This is an amber LED, which will report any over-temperature conditions that occur either in the BladeCenter chassis or the blade servers. If an over-temperature condition occurs, the BladeCenter unit may increase the speed of the blower to correct this, in which case the LED will automatically be turned off.

Information   The information LED is also amber. This LED reports non-critical events to the Error log. This LED must be manually switched off via the Management Module.

System- Error   Again, this is an amber LED, which reports when a system error occurs. This LED reports errors such as a failure on power, blower, or switch modules. It will also be on if a system error occurs on a blade. The failed component's LED will also be on to help isolate the error.

These system LEDs are also located on the rear of the BladeCenter chassis under blower module 2.
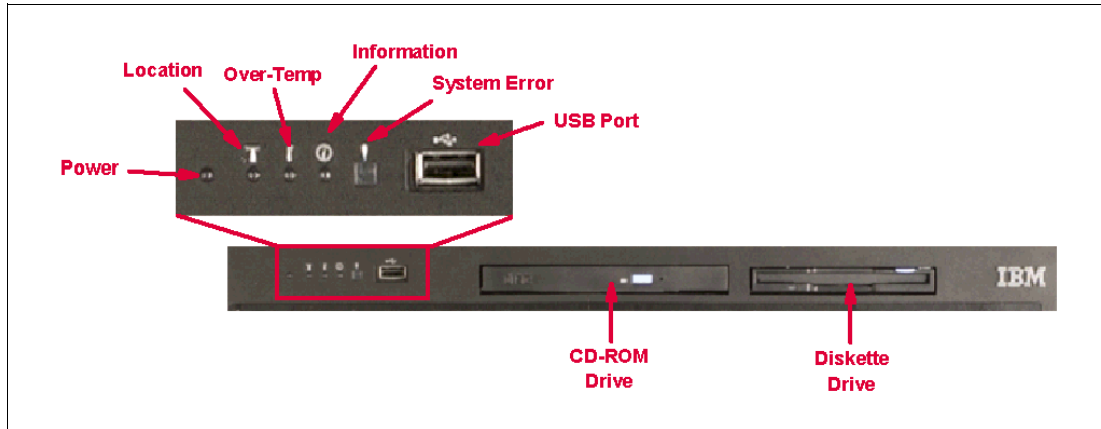
Figure 1-2   Media tray front view

As we discussed earlier, the BladeCenter chassis is capable of housing several hotswap and redundant components such as:

► Power supply modules
► Switch modules
► Management modules
► Blower modules

In Figure 1-3, you can see where each of these components should be located in the rear of the BladeCenter unit.
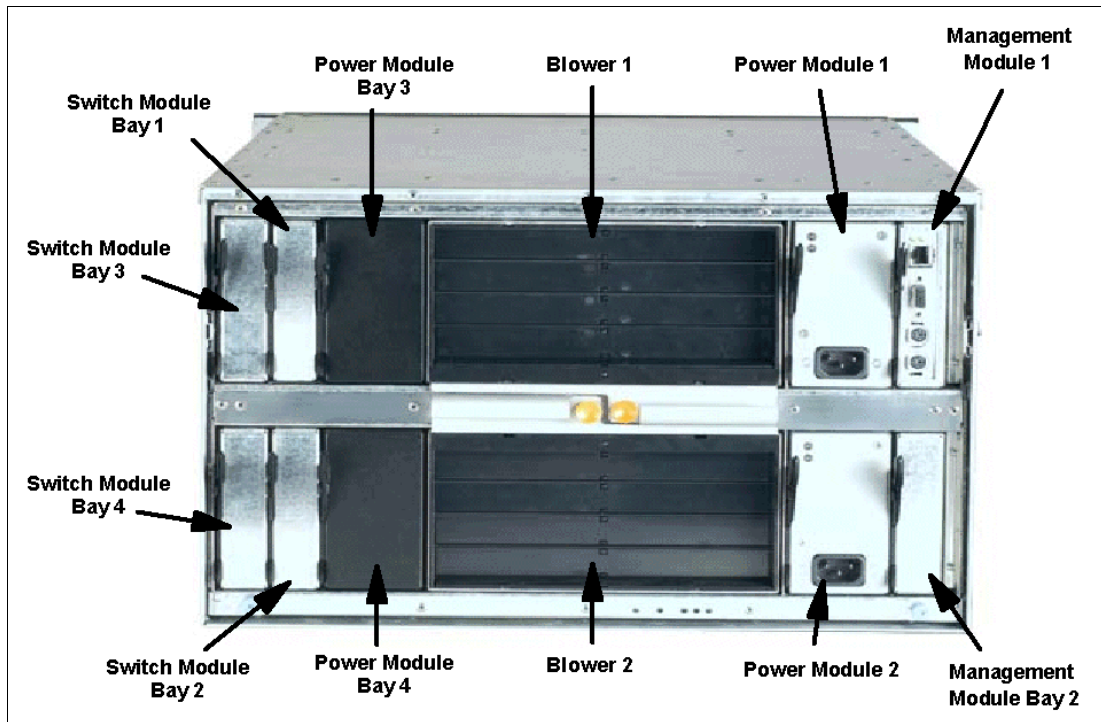
Figure 1-3   Rear view of BladeCenter chassis

The IBM @server BladeCenter automatically detects all blades and modules that are installed.

1.2.2 BladeCenter HS20

The BladeCenter HS20 blades are high-throughput, two-way SMP-capable Xeon-based blade servers, highly scalable by adding memory and a second processor. Two Intel Xeon connectors are standard on the blade board to support installation of a second processor. High-speed, PC2100 DDR SDRAM is synchronized for up to 400 MHz processor-to-memory subsystem performance with current processors. There are four memory DIMM connectors. Due to two-way interleaving, installation of memory options in pairs is required. Current memory options available are 256 MB, 512 MB and 1 GB size DIMMs, which support a minimum of 512 MB and a maximum of 4 GB of system memory. In the future, IBM will release a 2 GB memory option that will see the maximum system memory double from 4 GB to 8 GB.

Figure 1-4 shows the BladeCenter HS20 with its top cover removed.
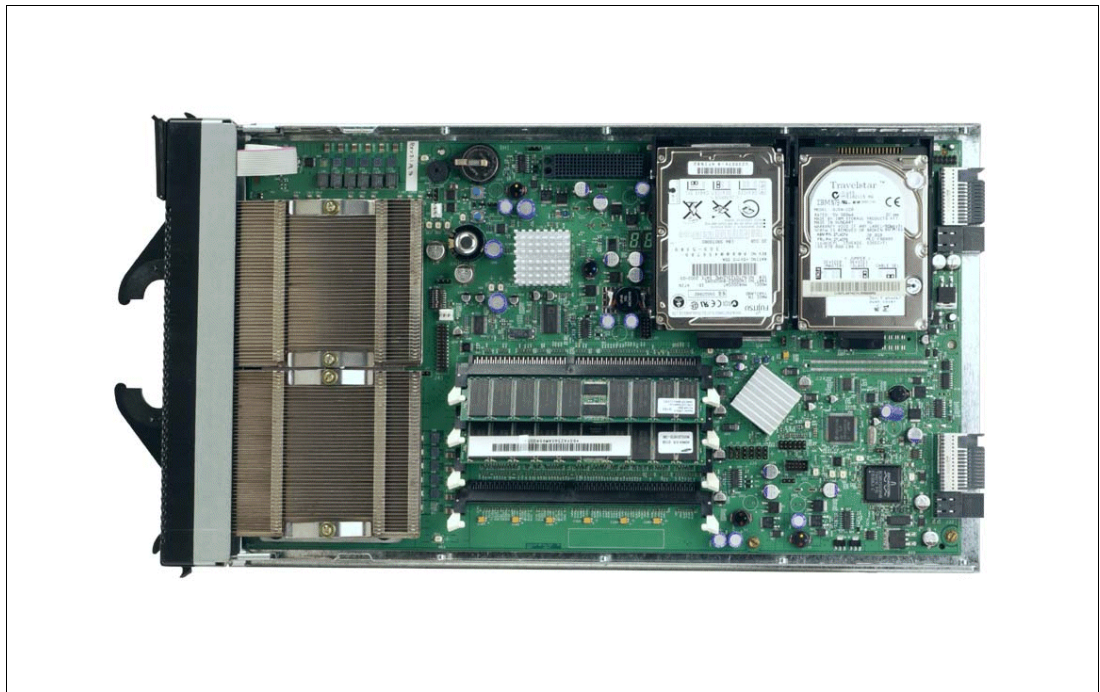
Figure 1-4   BladeCenter HS20 with top cover removed

Each BladeCenter HS20 has an integrated service processor on board that communicates with the BladeCenter Management Module to enable blade server management remotely. See 1.2.3, "BladeCenter Management Module" on page 8 for more details on the Management Module. The service processor provides the following functions:

► Loader and OS watch timer
► Remote soft shutdown
► POST watchdog timer
► Light Path support
► VPD support
► PFA for VRM/CPU/memory/HD
► Numeric based error log
► ASM interconnect support (RS485)
► Environmental querying and alerts (temp/voltages)
► Automatic server restart
► Remote power on/off
► In-band support for UMS/Director

- ► I2C interface to core logic (CSB5 chip)
- ► Local environmental monitoring
- ► Local LED control
- ► RS-485 interface to the Management Modules

The BladeCenter HS20 also has two integrated Ethernet controllers for redundancy. If redundancy is required, you must install Ethernet switch modules in switch module bays 1 and 2. See 1.2.6, "BladeCenter 4-port Ethernet Switch Module" on page 11 for more details. Each controller is auto-sensing and will connect at the appropriate rate, even if the transfer rate is 10 Mbps, 100 Mbps or 1000 Mbps. The controller will also set the appropriate duplex state.

The Ethernet controller is capable of providing several teaming options that increase throughput and fault tolerance. In your blade server, a team consists of the two Ethernet controllers to utilize the following options:

Adapter fault tolerance (AFT) Provides automatic redundancy for your Ethernet controllers. You can configure either one of the integrated Ethernet controllers as the primary Ethernet controller. If the primary link fails, the secondary controller takes over. When the primary link is restored to an operational state, the Ethernet traffic switches back to the primary Ethernet controller.

Adaptive load balancing (ALB) Enables you to balance the transmission data flow among the two controllers. ALB also includes the AFT option. You can use ALB with any 100Base-TX/1000Base-T switch.

Cisco Fast EtherChannel (FEC) Creates a team of the two controllers to increase transmission and reception throughput. FEC also includes the AFT option. You can use FEC only with a switch that has FEC capability.

The BladeCenter HS20 has a control panel that is located at the top of the blade servers (see Figure 1-5 on page 7).
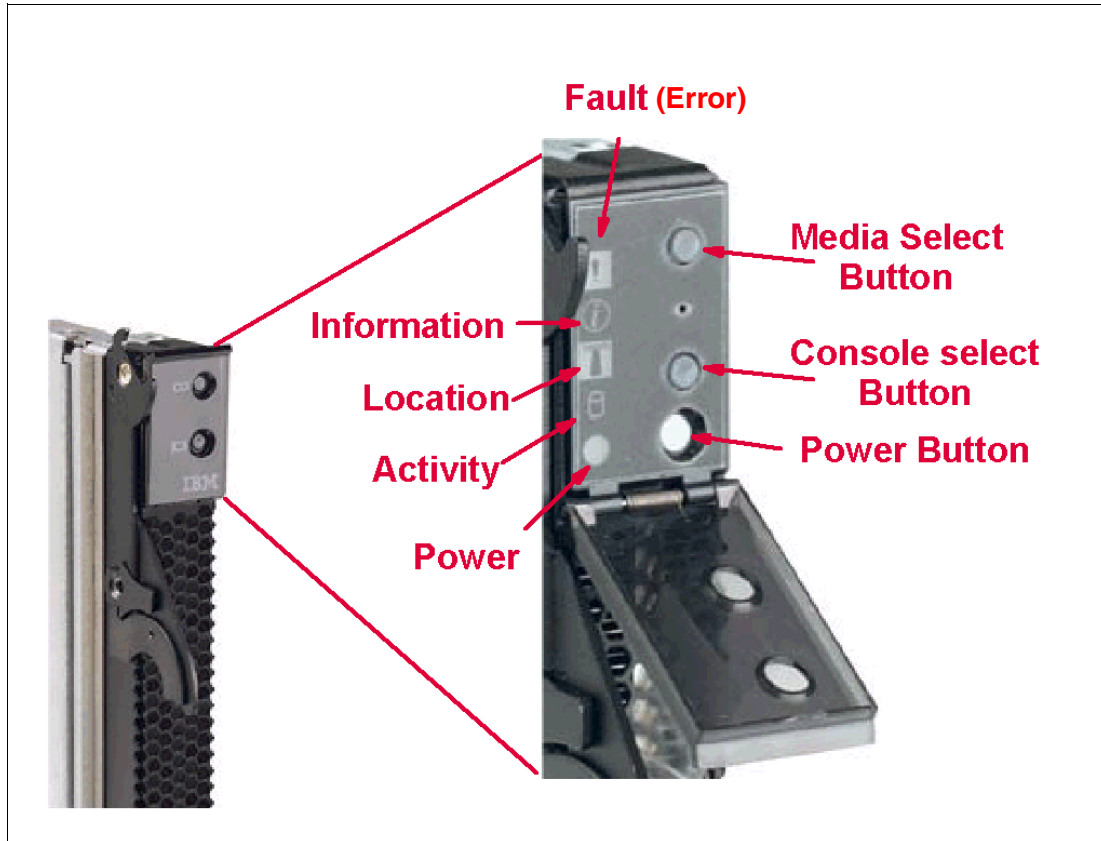
Figure 1-5   Blade server operators panel

Like the IBM @server BladeCenter's Media Tray, this control panel also has system information LEDs. The only difference is that the blade's panel also has control switches, as follows:

Media-select button   Press this button to associate the CD-ROM drive, diskette drive, and USB port with this blade server. This button lights when the ownership of the CD-ROM drive, diskette drive, and USB port transfers to this blade server.

Blade-error LED   This LED is also known as the blade system-error LED. When this amber LED is on, it indicates a system error has occurred in the blade.

Information LED   When this amber LED is on, it indicates information about a system error for this server has been placed in the BladeCenter System Error log.

Location LED   This blue LED has been turned on in response to a programmed condition, or remotely by the system administrator, to aid in blade identification for maintenance. The location LED on the IBM @server BladeCenter will be on also. Turn off the location LED after maintenance is complete.

Activity LED   When this green LED is on, it indicates that there is activity in the blade server. This includes hard disk and network activity.

Power-on LED   While the BladeCenter unit has AC power, this green LED turns on and stays on when you turn on your blade server.

Console select button   Press this button to associate the keyboard, mouse, and video ports with this blade server. This button lights when the ownership of the keyboard, mouse, and video transfers to this blade server.

Power-control button   This button is located behind the control panel door. Press this button to manually turn the blade server on or off.

> **Note:** The power-control button only has effect if the local power control option is enabled via the Management Module.

1.2.3 BladeCenter Management Module

The BladeCenter Management Module's primary function is to provide systems management for your IBM @server BladeCenter and blade servers. However, it does have other important functions, such as multiplexing the keyboard/video/mouse (KVM) to provide a local console for the individual blade servers as well as configuring the BladeCenter unit and switch modules. The Management Module communicates with all of the key components of the IBM @server BladeCenter including the switch, power, and blower modules as well as the blade servers themselves. The Management Module detects the presence, absence, and condition of each of these components. The IBM @server BladeCenter Management Module is shown in Figure 1-6.
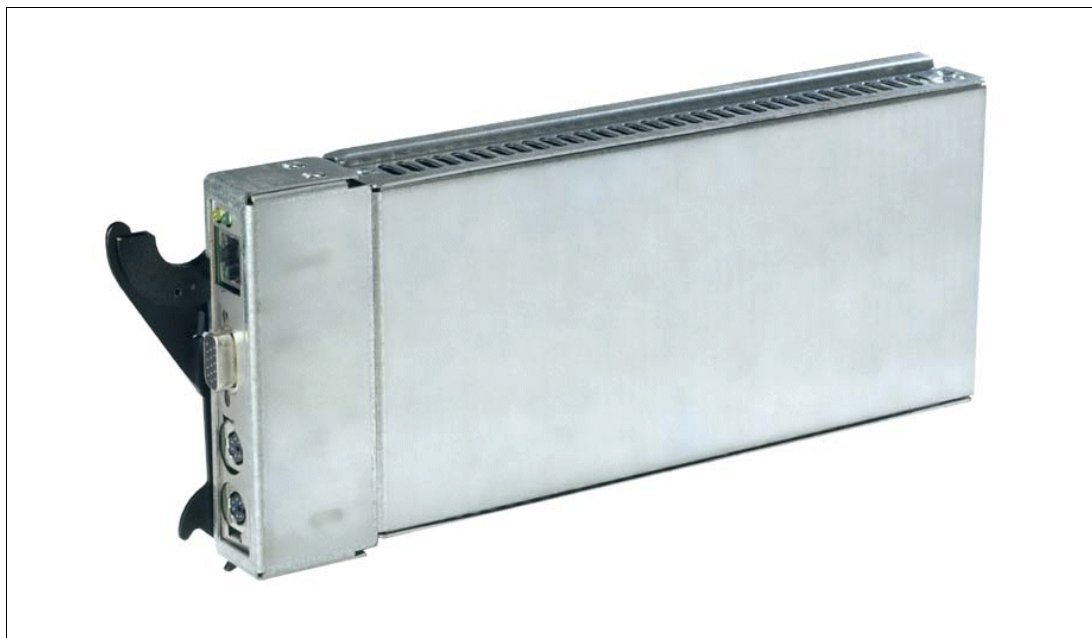
Figure 1-6   BladeCenter Management Module

The Management Module has a standard RJ45 connector for a 10/100 MB Ethernet remote console connection, as well as two PS/2® connectors for keyboard, mouse, and a 15-pin D-shell connector for video, which are provided for the local console. Although the connectors for the keyboard and mouse are PS/2 type connectors, these devices are routed to a USB bus enabling them to be switched between blades.

> **Note:** The operating system in each blade must provide USB support for the blade server to recognize and make use of the keyboard and mouse.

The Management Module will retrieve and monitor critical information about the chassis and blade servers, such as temperature, voltages, power supply, memory, fan and HDD status. This information will then be fed into an error and status log.

The manageability functions of the IBM @server BladeCenter are accessible via a Web GUI that is contained in the Management Module. This GUI allows you to view the status and control each blade server. This includes shutting down and restarting.

1.2.4 BladeCenter 1200W Power Supply Module

The standard BladeCenter chassis will ship with two 1200W power supply modules. However, depending on the configuration of your IBM @server BladeCenter, you may require all four power modules. The standard two power modules provide power for the following components:

- ► Blade slots 1 through 6
- ► Blowers
- ► Management modules
- ► Switch modules
- ► Media tray

Figure 1-7   BladeCenter 1200W Power Supply Module

Power modules 3 and 4 are required to provide power to blade slots 7 to 14. Figure 1-8 on page 10 shows how power is distributed by each power module. One power module is capable of providing enough power in the event of a power module failure. Power module 2 provides redundancy for power module 1 and power module 4 does the same for power module 3, although these power modules will effectively share the load under normal operating conditions. Supported configurations require either two or four power supplies, which is why when you order the optional BladeCenter 1200W Power Supply Module kit, you will receive two of the power modules.

> **Important:** Nonredundant power is not supported in BladeCenter products. Power modules must always be present in power bays 1 and 2. When any blade server or option is in blade bay 7 through 14, power modules must be present in power bays 1 and 2 as well as in power bays 3 and 4. If a power module fails or an ac power failure occurs, BladeCenter units configured for redundant power operation, as described in this document, will operate in a nonredundant mode, and the blower modules will run at full speed. You must replace the failing power module or restore ac power as soon as possible to regain redundant power operation and to reset the blower modules to their normal operating speed.

BladeCenter power module upgrade guidelines

This section contains information that will help you determine whether you need to upgrade the power modules in your IBM @server BladeCenter unit when installing IBM @server BladeCenter HS20 blade servers.

As of the date of this printing, three BladeCenter power-module options are available: IBM BladeCenter 1200W Power Supply Module (part number 48P7052), IBM BladeCenter 1200W to 1400W Power Supply Upgrade Kit (part number 90P0197), and IBM BladeCenter 1800W Power Supply Module (part number 13N0570). Go to `http://www.ibm.com/pc/compat/` for information about ordering these options. Obtain and use the Technical Update with your BladeCenter and blade server documentation for future reference.

The Technical Update can be obtained from the following URLs:

    http://www-1.ibm.com/support/docview.wss?uid=psg1MIGR-53353
    ftp://ftp.software.ibm.com/pc/pccbbs/pc_servers_pdf/13n0308.pdf
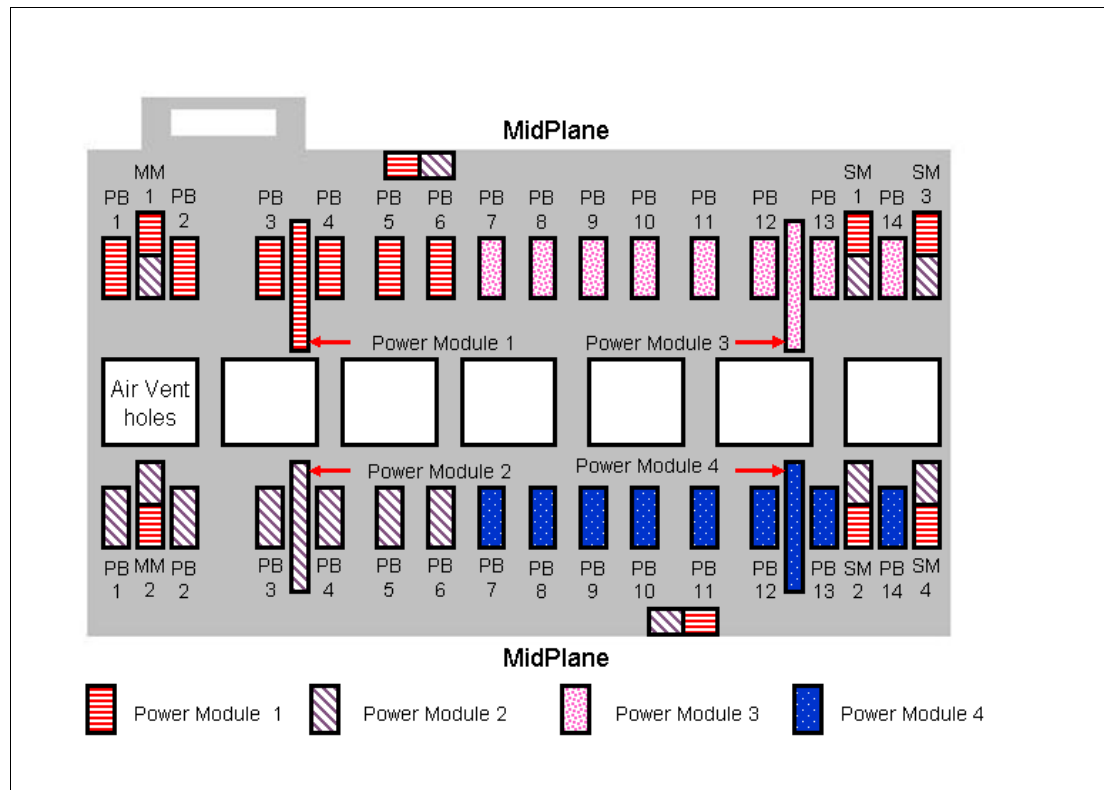
Figure 1-8   MidPlane power connector

1.2.5 BladeCenter blowers

The IBM @server BladeCenter ships with both hot-swap blowers. which are required to provide adequate cooling. These blowers provide a total airflow of approximately 325 CFM. However, each blower will run at approximately 50% under normal conditions. If one blower fails, the other blower is capable of providing enough cooling for the entire chassis. However, the failed blower should be replaced within 48 hours. The speed of the blowers is controlled via the Management Module, which receives signals from thermal monitors that are located in critical locations. There are two scenarios that will cause both blowers to function at full speed:

► If the Management Module fails and the redundant module is not present.
► If one of the power supply modules fails.

In Figure 1-9, you can see that there are four fins that are currently closed, since the blower is not operational. When operational, the blower draws the air from the front to the rear. Each blower also has a LED that will light up in the event of an error.

Figure 1-9   BladeCenter blower module

1.2.6 BladeCenter 4-port Ethernet Switch Module

The Ethernet switch module (Figure 1-10 on page 12) has several purposes. As well as providing network connectivity for the BladeCenter unit and blade servers, it also provide interconnectivity between the blades and Management Modules. The Ethernet switch module does not come standard with the IBM @server BladeCenter. It is available for purchase as an option, but it is required in most cases and should be installed in switch bay 1. This module is a fully functional Ethernet switch that has four 1000 Mbps ports externally, two internal 10/100 Mbps links to the Management Modules and 14 1000 Mbps links to the blades, which are also internal. Two of these switch modules can be added for redundancy. The switch module is configured via the Management Module.

Figure 1-10   BladeCenter 4-port Ethernet Switch Module

In Figure 1-10, the two LEDs at the top of the switch module indicate power-on and Ethernet switch error. There are also LEDs next to each port that indicate Ethernet link and activity.

1.2.7 BladeCenter Layer 2-7 GbE Switch Module

The Ethernet switch module (Figure 1-11 on page 13) has several purposes. In addition to providing network connectivity for the BladeCenter unit and blade servers, it also provides interconnectivity between the blades and management modules. The Layer 2-7 GbE Switch Module does not come standard with the IBM @server BladeCenter. It is available for purchase as an option, but it is required in most cases and should be installed in switch bay 1. This module is a fully functional Ethernet switch that has four 1000 Mbps ports externally, two internal 10/100 Mbps links to the Management Modules and 14 1000 Mbps links to the blades, which are also internal. Two of these switch modules can be added for redundancy. The switch module is configured via the Management Module. For a more in-depth look at Layer 2-7 Switching, refer to the Redpaper *IBM @server BladeCenter Layer 2-7 Network Switching*, REDP-3755.

Figure 1-11   BladeCenter 4-port Ethernet Switch Module

In Figure 1-11, the two LEDs at the top of the switch module indicate power-on and Ethernet switch error. There are also LEDs next to each port that indicate Ethernet link and activity.

1.2.8 BladeCenter 2-port Fibre Channel Switch Module

If you require Fibre Channel connectivity for your IBM @server BladeCenter, there are two things you are required to do:

1. Install the IBM HS20 Fibre Channel Expansion Card in each blade that requires a Fibre Channel connection; see Figure 3-4 on page 30.

2. Install one BladeCenter 2-port Fibre Channel Switch Module (Figure 1-12 on page 14) in switch bay 3. If redundancy is required, a Fibre Channel switch module must be installed in switch bay 4.

Each port on the Fibre Channel switch module is capable of supporting transmission speeds of either 1 or 2 Gbps and must auto-negotiate to match the speed of any connected devices. A small form factor pluggable (SFP) transceiver is required to populate these ports. These SFP transceivers are hot pluggable. The Fibre Channel switch module is also managed through the Management Module.

Figure 1-12   BladeCenter 2-port Fibre Channel Switch Module

The storage options for the IBM @server BladeCenter are covered in Chapter 3, "Storage options for the IBM eServer BladeCenter" on page 27.

1.2.9 BladeCenter Acoustic Attenuation Module

In environments where it is important to minimize sound emissions, there is a noise reduction option available that can be installed on the rear of the IBM @server BladeCenter. This option is called the BladeCenter Acoustic Attenuation Module (acoustic module or muffler). The acoustical noise emissions for a single BladeCenter unit configured with 14 BladeCenter HS20 servers are:

► 7.4 bels (operating)
► 7.4 bels (idling)

The acoustical noise emissions for a single IBM @server BladeCenter with a BladeCenter Acoustic Attenuation Module option installed and configured with 14 BladeCenter HS20 servers are:

► 6.9 bels (operating)
► 6.9 bels (idling)

For visibility purposes the system LEDs on the rear of the IBM @server BladeCenter have been replicated on the acoustic module, since these are covered when this option is fitted. The acoustic module also fully covers the blower modules and partly covers the other modules installed.

Note: The BladeCenter Acoustic Attenuation Module requires approximately 8 inches between the rear of the IBM @server BladeCenter the rack door. For this reason, the NetBay 42 Enterprise Rack Cabinet should be used when installing the BladeCenter unit with this option.

1.3 BladeCenter management

Effectively managing your hardware is important and can be a time-consuming task, which is why IBM has provided two methods of managing your IBM @server BladeCenter. The first is a simple-to-use Web GUI that is integrated in to the BladeCenter Management Module (see Figure 1-6 on page 8). This GUI allows remote connections from any terminal that is connected onto the same network as the Management Module. The alternative to the Web GUI is to use IBM Director V4.1, which is a simple yet comprehensive management solution.

1.3.1 Management module Web GUI

The Management Module's integrated Web GUI allows you to remotely login to your IBM @server BladeCenter via the Management Module enabling you to monitor, control, and maintain high-availability.

1.3.2 IBM Director V4.1

The latest in the series of IBM's industry-leading client/server workgroup manager, IBM Director V4.1 has many new features, including:

- ▶ Command-line interface support for many IBM Director management tasks.
- ▶ An easy, single point of deployment and management of new blade servers.
- ▶ Configuration wizards that streamline implementation and reduce complexity, saving valuable IT time and resources.
- ▶ Linux support for IBM Director's console and management server, facilitating the use of IBM Director in pure Linux environments.
- ▶ A new tool called Update Assistant makes the management and distribution of system updates a breeze.
- ▶ IBM Director Server Plus Pack, the new and enhanced extensions to IBM Director for advanced server management to help optimize performance and maximize availability.

In addition to the many new features, IBM Director V4.1 now includes support for your BladeCenter server enabling you to manage, deploy, and monitor your system much more efficiently, which helps reduce cost by:

- ▶ Reducing down time
- ▶ Increasing productivity of IT personnel and end users
- ▶ Reducing service and support cost

For more information, see 2.1, "System management" on page 17 and also the Redpaper *IBM @server BladeCenter Systems Management,* REDP3582.

2

The advantages of IBM eServer BladeCenter

Unlike typical server architecture, which scales up, the IBM @server BladeCenter allows for the scale-out approach, yet it balances performance and density. In this chapter we discuss topics that help you identify the advantages of the IBM @server BladeCenter for your business, such as:

► Systems management
► High density computing
► Redundancy

2.1 System management

The systems management component for the IBM @server BladeCenter is the combination of IBM Director, the Web interface and Rapid Deployment Manager (RDM). With these tools you are able to reduce system outages, increase IT personnel productivity, and reduce support costs.

2.1.1 IBM Director

IBM Director V4.1, is the industry-leading client/server workgroup manager. IBM Director's tools provide customers with flexible capabilities to realize maximum system availability and lower IT costs. With IBM Director, IT administrators can view and track the hardware configuration of remote systems in detail and monitor the usage and performance of critical components, such as processors, disks, and memory.

IBM Director provides a comprehensive view of the xSeries servers:

► Remote access to the server regardless of its status
► Reset or cycle the server
► Server inventory, AssetID, blade slot numbers utilized
► Monitor and set thresholds on the server events including PFA
► Flash BIOS
► Monitor and identify potential performance bottlenecks

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IBM Director allows you to reduce system outages, increase IT personnel productivity and reduce support costs. These can be accomplished by:

- ► Monitoring server health
- ► Predictive Failure Analysis® (PFA)
- ► Integration with enterprise system management environments

Monitoring server health

By setting thresholds on components within IBM Director, you are able to monitor the following:

- ► Operating system load
- ► POST time-out
- ► Voltage
- ► Temperature

Predictive Failure Analysis (PFA)

Setting alerts on disk, memory, and processors via PFA allows you to identify imminent component failure. PFA can monitor the following:

- ► Processors
- ► Memory
- ► Fans
- ► Power supplies
- ► SCSI HDDs

Integration with enterprise system management environments

IBM Director agents should be installed on each of the blade servers, since this allows system management of the blades and it also provides the advanced management capabilities of the xSeries servers to be accessed from such products as:

- ► Tivoli® Enterprise™ and Tivoli NetView®
- ► Computer Associates CA
- ► Unicenter TNG
- ► HP OpenView
- ► Microsoft SMS
- ► BMC Patrol
- ► NetIQ

This is an important consideration for organizations that have already spent time, money, and resources on existing system management tools.

2.1.2 Web interface

The Web interface allows you to configure and remotely manage your BladeCenter unit via a browser built into the Management Module.

Supported browsers and required components:

- ► Microsoft Internet Explorer 4.0 Service Pack 1, or later
- ► Netscape Navigator 4.72, or later (version 6.0 is not supported)
- ► Java™-enabled Web browser
- ► Support for JavaScript 1.2 or later
- ► HTTP 1.0, or later
- ► Minimum display resolution 800*600 pixels and 256 colors

Note: The Web interface does not support double-byte character set languages (DBCS).

The Management Module Ethernet port either receives a DHCP assigned address within 2 minutes of connecting to the LAN, or it defaults to the following IP address: 192.168.70.125 with a subnet address of 255.255.255.0. The default hostname is MMxxxxxxxxxxxx, where xxxxxxxxxxxx is the MAC address.

Note: If multiple BladeCenter systems are to be configured, only one can be assigned the default IP address of 92.168.70.125. Otherwise, IP address conflicts will occur.

If your DHCP server is not on the same subnet as the BladeCenter Management Module console, DHCP traffic needs to be allowed to traverse the router to the Management Module console to receive an DHCP assigned address, or IBM Director Server needs to be on the same subnet as the IBM @server BladeCenter.

The Web interface allows you to manage and check the status of each of the modules and blade servers. Below is a list of the functions and subfunctions available:

► Monitor

– System status
– Event log
– Vital product data

► Blade Tasks

– Power/restart
– Firmware update
– Configuration

► Switch tasks

– Power/restart
– Management

► MM console - (Management Module)

– General settings
– Login profiles
– Alerts
– Network interface
– Network protocols
– Security
– Configuration file
– Fireware update
– Restore defaults
– Reset MM

► Log off

2.1.3 Rapid Deployment Manager (RDM)

This powerful tool allows you to deploy system images to the blade servers from the administrator's console.

RDM supports the following environments:

► Windows 2000
► Windows 2000 Advanced Server

The advantages of Rapid Deployment Manager are:

► Rapid deployment of operating system image to the destination server initially and failed servers

► Hot-spare blade option (see 2.3.1, "Hot-spare blades" on page 23)

2.2 High-density computing

As data centers have grown with the proliferation of Wintel servers over recent years, rack space and floor space can be more efficiently used with the use of blade servers. A fully populated 42U rack is capable of holding six IBM @server BladeCenters and 84 dual processor blade servers, which gives a total of 168 CPUs per rack. This is twice the current density of a non-blade server. The IBM @server BladeCenter supports a minimum of one 4-port 1 GB Ethernet switch for up to 14 blade servers. A total of four switch modules can be utilized within the BladeCenter unit. This can be a combination of either Fiber Channel or Ethernet.

We recommend the use of blade servers for the following situations:

► Space-constrained environments
► WebSphere®
► Linux clusters
► Web caching
► Collaboration applications (Lotus® Notes®, Microsoft Exchange and Citrix)
► Dynamic Web serving - Load balancing
► Firewall
► Telecommunications
► Active directory services
► Scientific and technical computing

These applications are typically processor and memory intensive, which lend themselves to the scale-out option rather than the scale-up. The scale-out option is where the strength of the IBM @server BladeCenter becomes obvious. Due to the highly scalable range of components available with the IBM @server BladeCenter, the blade server has a huge market.
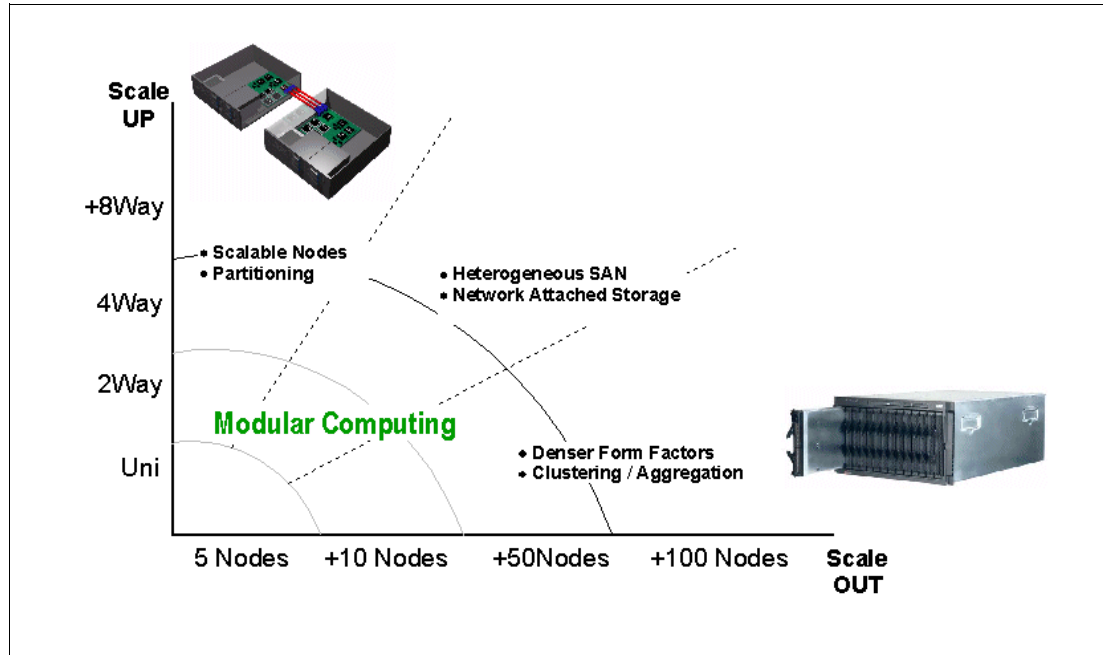
Figure 2-1   Scale up vs scale out

There are also attractive cost savings where a large number of rack-installed servers are required. These savings run from power usage to hardware procurement, due to not duplicating components, through to server management. Table 2-1 demonstrates the input voltage required for different servers providing the same number of CPUs. It also shows the heat output in BTU, which can affect the cooling of your computer room and other equipment within the computer room.

Table 2-1   Power and BTU usage

	Number of Servers	Processor	Maximum load watts	BTU
IBM x330 4MX	14	Pentium® III 1.4GHz	3080	10502
IBM x335	14	Xeon 2.4GHz	4760	16231
IBM x342 - Dual Power	14	Pentium III 1.4GHz	5250	19821
IBM x345 - Dual Power	14	Xeon 2.4GHz	7000	23870
IBM BladeCenter	14	Xeon 2.4GHz	2500	8530

Note: The IBM @server BladeCenter in Table 2-1 is utilizing the onboard IDE controller.

The deployment of an IBM @server BladeCenter is far simpler than deploying 14 1U servers and the cables associated. A single IBM @server BladeCenter only requires a KVM cable, one power cable, one Ethernet cable, and a single system management cable. Even with redundancy of these components, cabling can be reduced by 83 percent. See Table 2-2 on page 22 for a typical example.

Table 2-2   Cable utilization

	1U Solution (2 - 42U Racks)	IBM @server **BladeCenter** **Solution** **(2 - 42U Racks)**
Power	84	12
Ethernet	168	48
KVM	84	6 (ACT)
Switch	6 (boxes)	1 (ACT)
KVM interconnect	5	0
Management connect	84	6
Total	431	73

The IBM @server BladeCenter is not intended to replace any of the xSeries suite, but rather to provide additional configuration options.

2.3 Redundancy

We all know failures occur occasionally. We also know redundancy of key components increases system availability, but it has been expensive to purchase redundant options for individual servers. The high-availability features found in conventional xSeries rack servers have also been included within IBM @server BladeCenter. These features include:

► Hot-spare blades
► Processor
► Memory protection
► Disk mirroring
► MidPlane
► Hot-swap power and cooling modules
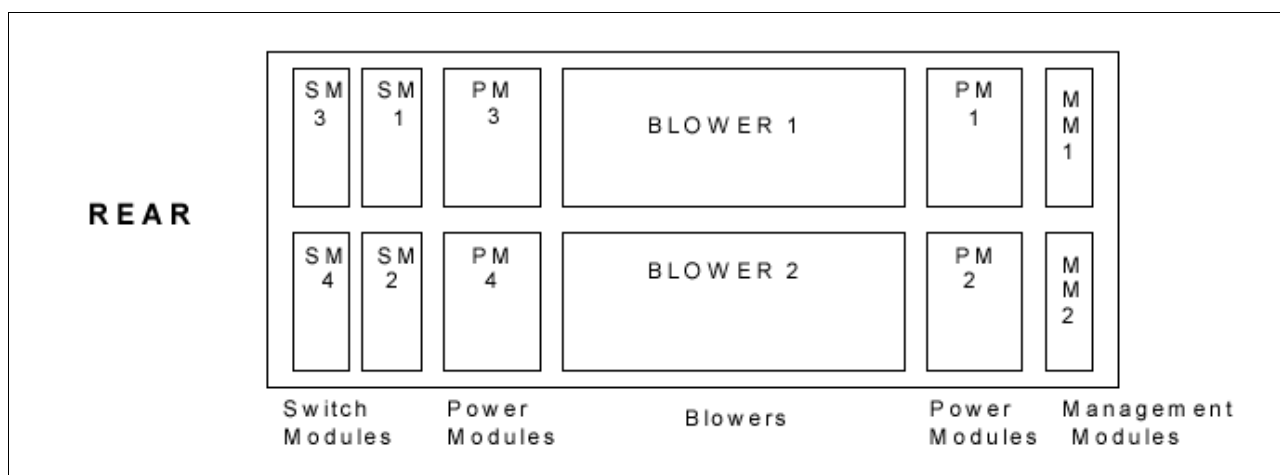► Switch modules

Figure 2-2   Module location on the rear of the IBM @server BladeCenter

Table 2-3 on page 23 outlines which components can be redundant, hot swap, PFA, or have Light Path Diagnostics.

Table 2-3   Redundant, hot-swap, PFA or Light Path

	Redundant	Hot swap	PFA	Light Path
Blade	Yes	Yes	No	Yes
Processor	Auto Recovery	No	Yes	Yes
Memory	ECC w/Auto down size	No/Tool less	Yes	Yes
Power supplies	Yes	Yes	Yes	Yes
Cooling fans	Yes	Yes	Yes	Yes
Management module	TBD	TBD	TBD	TBD
Switch module	Yes	Yes	TBD	TBD
Backplane	Yes	No	No	No
Front plane /Media Tray	No	Yes	No	No
CD ROM drive	No	No	No	No
Floppy drive	No	No	No	No
Hard drive	Raid	Only with Blade Storage expansion (HS SCSI drives)	Yes	Yes
Power cable	Yes	Yes	No	No

2.3.1 Hot-spare blades

MidPlane supports hot-spare blade servers. This operates in the same fashion as the hot-spare drive. By creating events within IBM Director, you are able to deploy an operating system to a hot-spare blade server automatically.

2.3.2 Processor

In a dual processor blade server, if a CPU fails the following steps occur:

1. Force failed processor offline
2. Automatically re-boot server
3. Generate alerts
4. Continue operating with the working processor

2.3.3 Memory

There are four memory slots. Memory must be installed in matching pairs. The following redundancy options are available:

► Chipkill ECC - provides correction for up to 4 bits per DIMM
► Memory hardware scrubbing - correcting soft memory errors automatically
► PFA - Creating alerts of imminent failure

2.3.4 Disk mirroring

Refer to Chapter 3, "Storage options for the IBM eServer BladeCenter" on page 27 for hardware and software mirroring options of IDE and SCSI disks.

2.3.5 MidPlane

The middle plane provides connectivity between the blades and the modules at the rear of the IBM @server BladeCenter. There are two connections on each blade server to independent middle planes for redundancy.

2.3.6 Hot-swap power and cooling modules

By sharing fans, power supplies, cables and other components within an IBM @server BladeCenter and installing the redundant options for these, your organization can reduce the number of points of potential failure, thus increasing system availability.

Blowers

Two hot-swap blowers are standard in the IBM @server BladeCenter. The blower speed varies depending on the temperature. A failed blower needs to be replaced within 48 hours.

Note: An Acoustic Attenuation Module can be fitted to reduce noise.
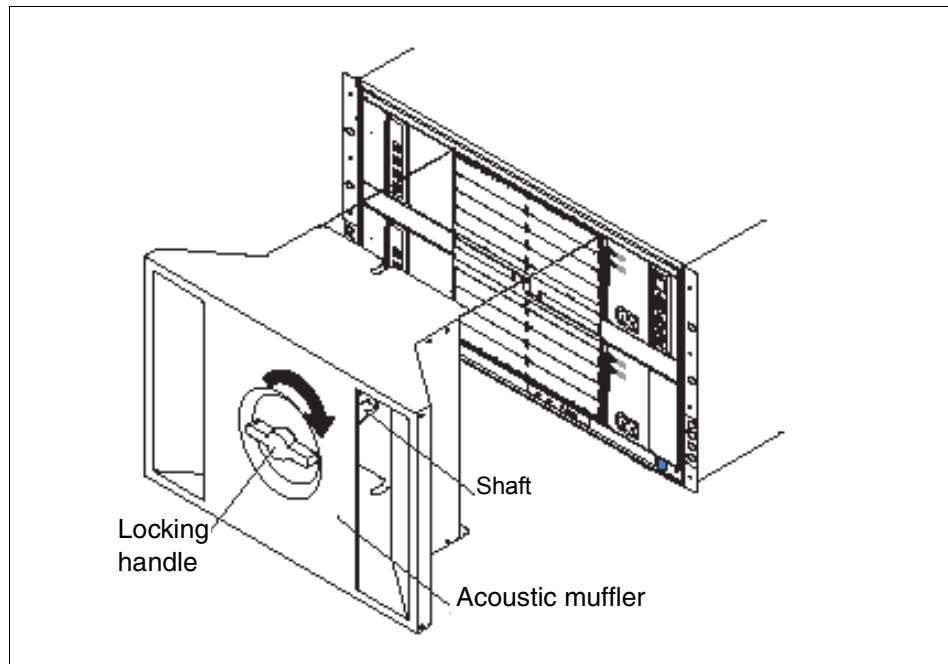

Figure 2-3   Acoustic attenuation module

Power

The IBM @server BladeCenter comes with two 220 volt 1200 watt hot-swap power modules in power bays 1 and 2. Table 2-4 on page 25 outlines the power module bays and their functions.

Table 2-4   Power module bays

Power module bays	Power module function
1	Provides power to all the IBM @server BladeCenters modules in server bay slots 1-6.
2	Redundancy for power module bay 1.
3	Provides power to all the IBM @server BladeCenters modules in server bay slots 7-14.
4	Redundancy for power module bay 3.

Note: A blade server in bay 6 with SCSI storage expansion option requires a power module in power module bays 3 and 4 to support the SCSI storage expansion.

2.3.7 Cabling modules

The IBM @server BladeCenter is capable of managing four switch modules of either Ethernet or Fibre Channel. The minimum requirement is a single Ethernet switch.

Ethernet

Two hot-swap 1 GB Ethernet 4-port switch models can be installed in switch module bays 1 and 2.

Fibre Channel

Two hot-swap Fibre Channel network interface switch modules can be placed in switch module bays 3 and 4.

Note: The IBM @server BladeCenter also includes a hot-swap Media Tray, which includes the CD-ROM and floppy drive.

3

Storage options for the IBM eServer BladeCenter

The IBM @server BladeCenter, although very dense, offers great storage options. The IBM @server BladeCenter gives you the option to use:

- ► IDE
- ► SCSI
- ► Fibre Channel

You can run RAID on the blade servers with these options. RAID 1 is the only option you have with IDE and SCSI. RAID 1 is basically disk mirroring. It is RAID 1 on the boot volume only with a hot spare drive. The second drive will physically mirror the drive that has data written on it in case of a failure.

The BladeCenter system is the moderator of all activity. Blade servers do not attach to the storage directly. They are connected through controllers on the IBM @server BladeCenter's board. Depending on the type of card used, the signals will be routed to one of two places: the Fibre Channel switch module or the SCSI expansion slot.

3.1 IDE

The blade servers within the IBM @server BladeCenter is Integrated Drive Electronics (IDE) compatible. All models are open-bay with the option to add one or two drives depending on your solution. (IDE normally passes single ended.) It is very reliable, but works on a smaller scale than SCSI.
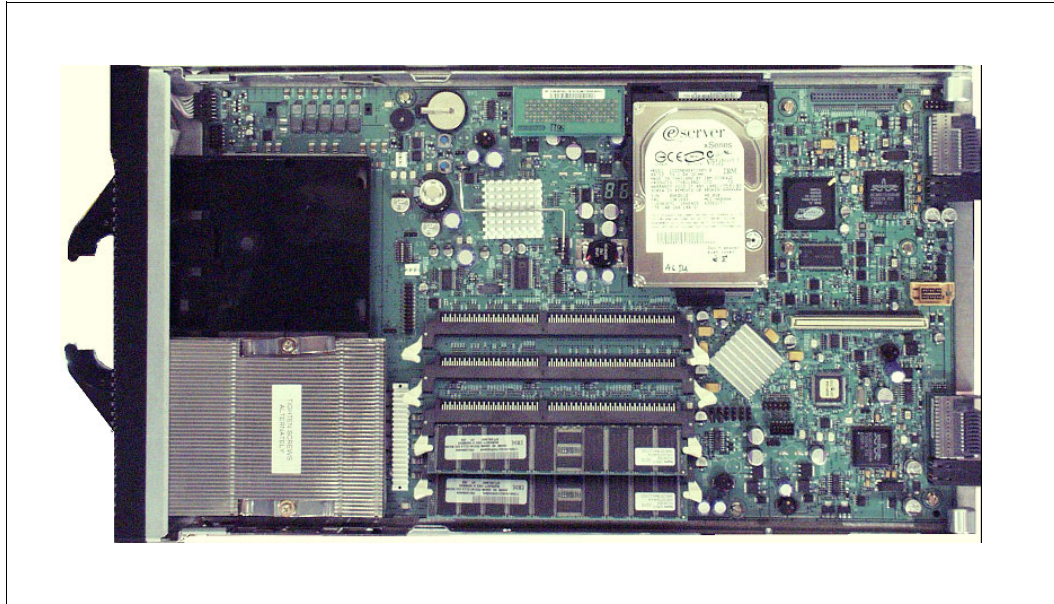
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Figure 3-1   Un-covered blade showing single IDE drive

The IDE drive used for the blades are 40 GB. The blade server is able to hold two of those drives internally. That will give you 80 GB of storage per blade. You will need to run a software RAID if you want to mirror the drives. A fully populated IBM @server BladeCenter with each blade having two IDE drives gives you approximately 1 TB of storage without running RAID. If you implement RAID 1, it reduces the actual storage by half.

3.2 SCSI

The blade server offers a SCSI solution even though no SCSI drives are supported internally. SCSI (Small Computer Systems Interface) is a parallel interface designed to set a standard of communication between peripheral devices. SCSI offers the reliable technology for direct attachment of storage devices. This is achieved by the SCSI Expansion Unit.
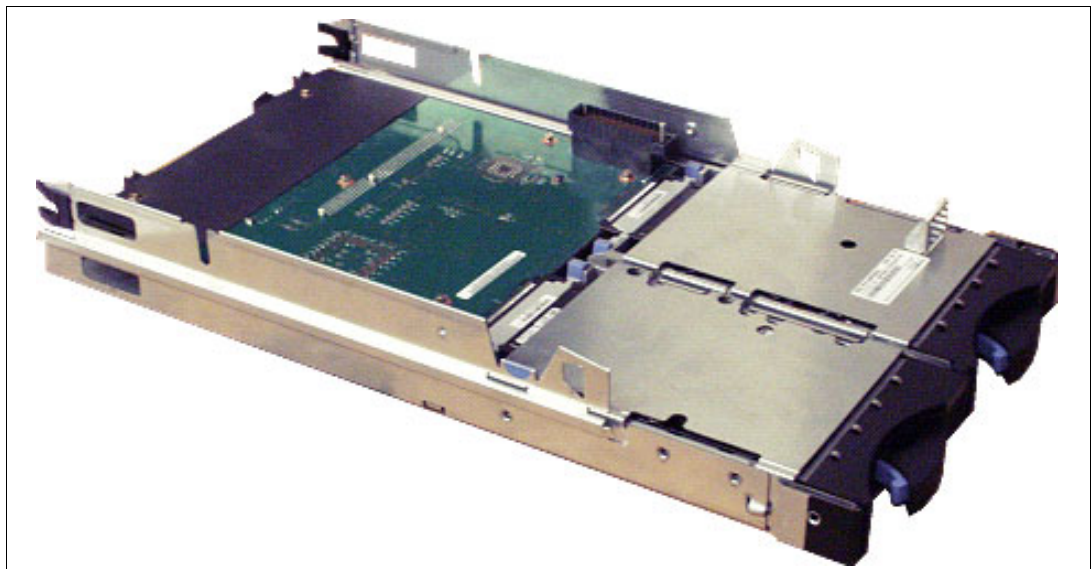

Figure 3-2   SCSI Expansion Unit

The SCSI Expansion Unit is a device that houses two SCSI drives and attaches directly to the blade server. There is a LSI 53C1020 Ultra320 SCSI controller onboard. All SCSI Ultra320 and Ultra160 drives compatible with the xSeries are supported in this expansion unit. The controller onboard will allow you to run RAID 1. To attach the SCSI Expansion Unit, you will need to remove the top cover of the blade server. Then remove the SCSI expansion terminator from the integrated SCSI connector. See Figure 3-3.
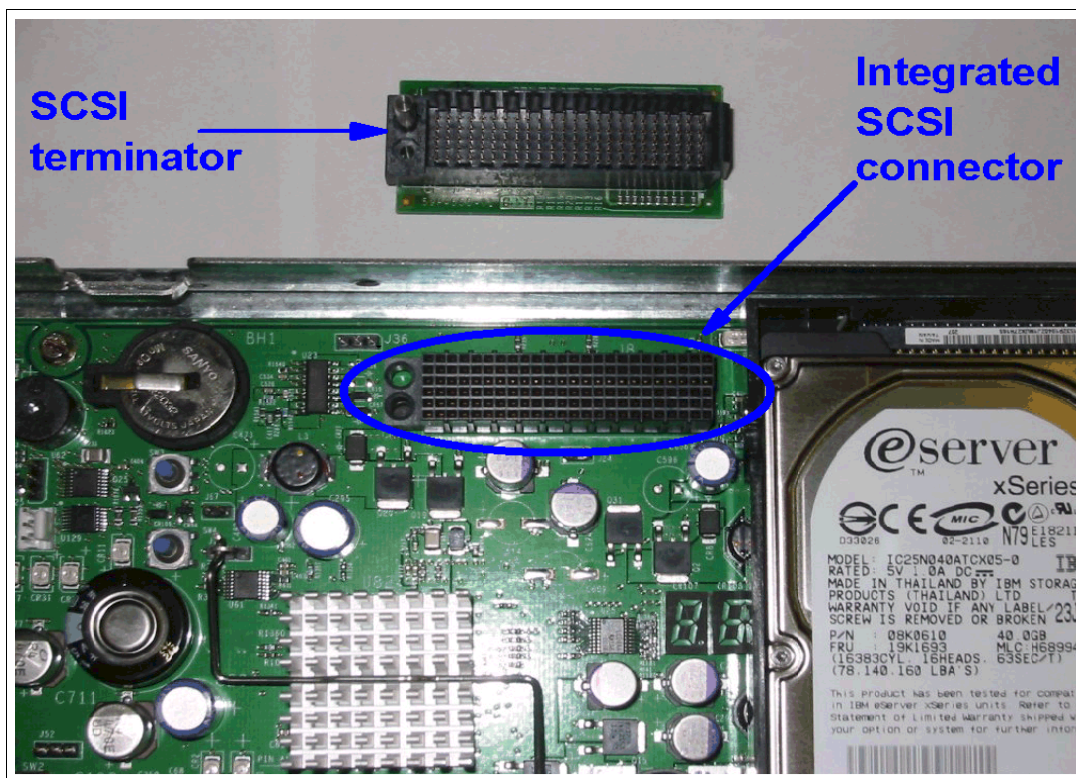

Figure 3-3   SCSI terminator removed

When completed, line the SCSI Expansion Unit directly on top of the blade server so the pins could snap directly into the slot where the terminator used to be. That will make the blade server a little wider and that means two slots will be used in the IBM @server BladeCenter, so every Expansion Unit takes away a slot for a blade server. If you want a SCSI solution in a fully populated IBM @server BladeCenter, you can only have seven blade servers along with seven expansion units. You can still achieve approximately 1 TB of storage by using the 73 GB drives and not running RAID. If you run a RAID 1, it reduces the actual storage by half. IBM @server BladeCenter will allow you to use SCSI and IDE together. You have the option to use the internal IDE drives along with the external SCSI drives. Using this scenario running RAID 1 on both IDE and SCSI will give you about 700 GB of usable storage.

3.3 Fibre

The IBM @server BladeCenter allows you to connect to a SAN solution via a Fibre Channel switch module. The blade servers will need the IBM @server BladeCenter HS20 Fibre Channel expansion card (Figure 3-4 on page 30) placed internally to access the Fibre Channel switch module. Fibre Channel is a scalable, high-performance interconnect that enables fast transfer of data. Fibre Channel is capable of supporting multiple protocols and a variety of topologies. It provides high bandwidth, the ability to share storage among many servers, and a more reliable and flexible storage with continuous data availability.
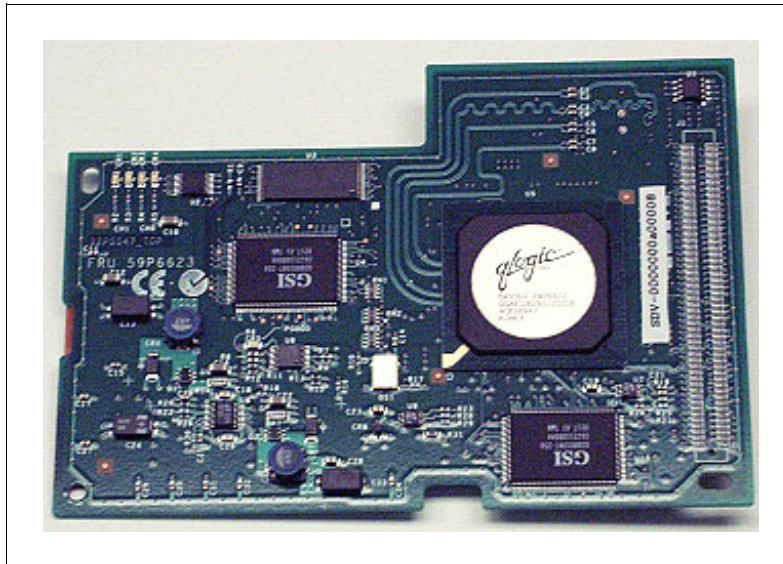
Figure 3-4   Fibre Channel expansion card

Since there are no PCI slots available in the blade servers, the Fibre Channel expansion card attaches to the second connector that would normally be occupied by one of the IDE drives. There should not be a problem removing a drive to fit this card, since the blade server is considered a diskless system when attaching to a SAN.

4

Installation considerations and generic configurations

In this chapter, we explain how to install Windows 2000 on the IBM @server BladeCenter and provide a number of possible configurations of the BladeCenter servers.

4.1 Installation considerations

Because of the design of the IBM @server BladeCenter, there are some considerations that you have to keep in mind when you install an operating system onto one of the blade servers. At the present time, the following operating systems are supported on the BladeCenter servers:

► Microsoft Windows 2000 Server with SP3
► Microsoft Windows 2000 Advanced Server with SP3
► Red Hat Linux 7.3
► SuSE Linux 8.0

This chapter covers how to install Windows 2000 Server or Windows 2000 Advanced Server. In the example, we use d:\images as the example directory and we install Microsoft Windows 2000 Advanced Server.

4.2 How to install Windows 2000 on the BladeCenter server

In this section, we install Windows 2000 Advanced Server on an IBM @server BladeCenter server via a CD-ROM, the remote installation service (RIS), and the Remote Deployment Manager (RDM).

4.2.1 Installation from CD-ROM

When installing Windows 2000 Advanced Server on the IBM @server BladeCenter from a CD-ROM, you have to modify the CD-ROM to include Service Pack 3. This is because the operating system cannot be installed from the original CD-ROM or diskette drive, since they

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reside on a USB bus. To create a bootable CD-ROM with Service Pack 3, complete the following steps:

1. Download and extract the service pack with the /x option to the directory d:\images\sp3\. This will unpack the service pack without installing it.

2. Copy the i386 directory from the W2K Advanced Server CD to the machine with the CD writer to the directory d:\images\bootcd\i386.

3. Apply the service pack with the /s option to the d:\images\bootcd\ directory.

4. Extract the boot sector from the Windows 2000 Advanced Server installation CD-ROM using an appropriate application. Several CD-writing applications have this functionality.

> **Note:** At the time this Redpaper was written, an official Microsoft Windows 2000 Server with integrated Service Pack 3 CD-ROM was not available. Check the World Wide Web for numerous procedures on how to create a bootable Windows 2000 Server CD-ROM with Service Pack 3.

5. Copy the boot sector to the machine with the CD writer to directory d:\images\bootsect\.

6. Make sure the following files are located in the d:\images\bootcd\ directory. The files not present should be copied to d:\images\bootcd directory from the original CD-ROM.

   – CDROM_NT.5

   – CDROM_IA.5, CDROM_IS.5, or CDROM_IP.5 depending on the version of Windows 2000: Advanced, Standard or Professional.

   – CDROMSP3.TST

   – Optionally copy the following files from the original CD-ROM: Autorun.inf, Read1st.me, readme.doc and setup.exe.

7. Use CD-writer software that is capable of creating bootable CD-ROMs.

8. Use the following settings in your CD-writer application. Settings might look slightly different or may not exist at all, depending on the CD-writer application used.

   – Set load segments to 07C0.
   – Set sector count to 4.
   – Set emulation-mode to no emulation.
   – Enable joliet extensions.
   – Set CD format to mode 1.
   – Set file/directory length to ISO level 2.
   – Set file system to ISO9660.
   – Use disc-at-once as recording method.
   – Point out the Bootsector file located in d:\images\bootsect\.

9. Write CD-ROM by clicking **Finalize.**

4.2.2 Remote-installation service (RIS)

When doing a RIS-installation you need a separate machine to install the operating system onto a blade server. Also, you need Service Pack 3 on that server to get support to use the RIS functionality with Windows 2000 Server or Windows 2000 Advanced Server. The follwoing are a few considerations for the RIS server:

► The RIS images cannot be located on the system drive.
► The file system has to be NTFS 5.
► The installation has to be run over the network via PXE-boot.

▶ Trying to boot the machine from a RIS-start disk will result in the error shown in Example 4-1.

Example 4-1   Error from RIS bootfloppy

```
Windows 2000 Remote Installation Boot Floppy

Error: Could not find a supported network card. The boot floppy currently supports a
limited set of PCI based network cards for use with the Windows 2000 Remote Installation
Service. Ensure this system contains one of the supported network cards and try the
operation again. For assistance, contact your system administrator.
```

To create a RIS installation image of Windows 2000 Server, perform the following:

1. Download and extract the service pack with the /x option to d:\images\sp3. This will unpack the service pack without installing it.

2. Apply the service pack to the RIS server and reboot by running the update.exe file located in d:\images\sp3\i386\update.

3. Copy the information from the installation directory on the CD-ROM onto the RIS server using directory d:\images\w2kadv\i386.

4. Run the update.exe application from the unpacked service pack with the /s option located in d:\images\sp3\i386\update. The command should look like this:

   ```
   update.exe /s:d:\images\w2kadv\
   ```

5. Install the remote installation service:

   a. Click **Start** -> **Settings** -> **Control Panel.**

   b. Click **Add/Remove Programs**.

   c. Click **Add/Remove Windows Components**.

   d. Scroll down to Remote Installation Services (Figure 4-2 on page 34).
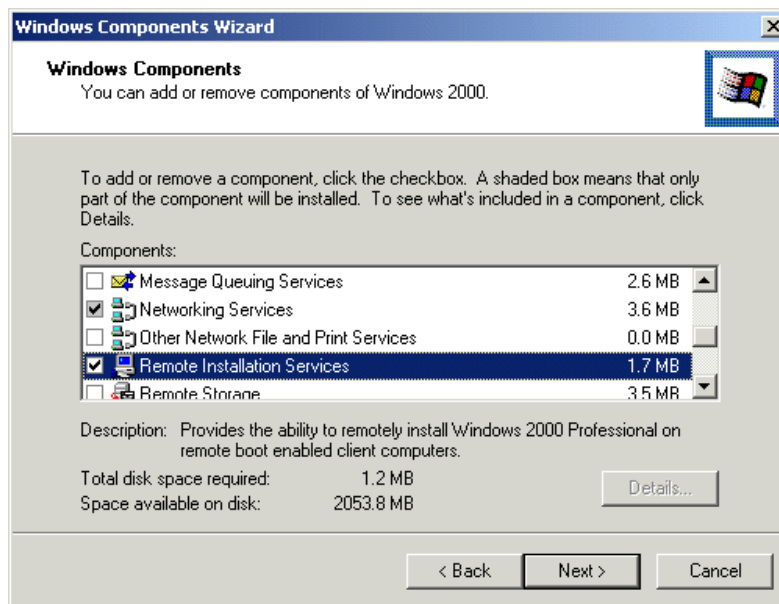

Figure 4-1   Installation of RIS onto a Windows 2000 Server

   e. Select **Remote Installation Services**.

   f. Click **Next**.

g. Click **Finish**.

h. Restart the server.

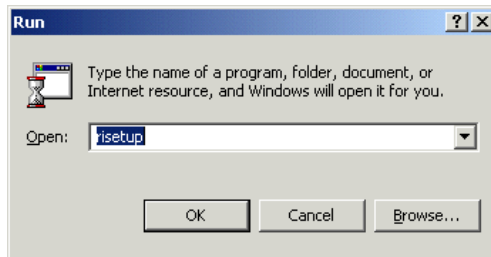6. Run **RISETUP** to create an installable image of the operating system.

Figure 4-2   Starting Remote installation setup

7. Click **OK**.

8. Click **Next**.

9. Choose a folder for the RIS installation, for example e:\remoteinstall. It must be an NTFS volume and cannot be the system drive.

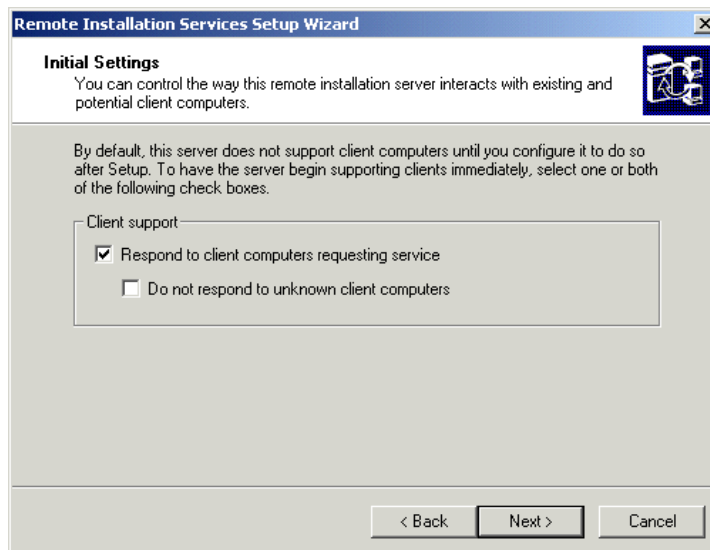10.Select **Respond to client computers requesting service** (Figure 4-3) and click **Next**.

Figure 4-3   Settings for RIS-installation

11.Enter the directory where the i386 directory resides: d:\images\w2kadv\i386

12.Enter an appropriate name for the installation, for example, win2000.adv.

13.Click **Next -> Next -> Finish**.

14.Wait for the installation to complete and click **Finish**.

15.Download the driver for the Broadcom Gigabit network interface and unpack it.

16.Copy the .inf file and the .sys file to the i386 directory located in d:\remoteinstall\setup\english\win2000.adv\i386.

17.Start a command prompt and restart the RIS-server (see Example 4-2 on page 35):

```
net stop binlsvc
net start binlsvc
```

Example 4-2   Restarting the RIS service

```
Microsoft Window 2000 [Version 5.00.2195]
<C> Copyright 1985-2000 Microsoft Corp.

C:\>net stop binlsvc
The Boot Information Negotiation Layer service is stopping.
The Boot Information Negotiation Layer service was stopped successfully.

C:\>net start binlsvc
The Boot Information Negotiation Layer service is starting.
The Boot Information Negotiation Layer service was started successfully.

C:\>
```

18.Installing a blade server with this configuration will result in having two unknown drivers in Device Manager ,which are the Broadcom drivers. To modify the installation to avoid this, see 4.3, "Modifying the installation to incorporate network drivers" on page 44.

19.Boot the blade server and press F12 during startup. When the Broadcom network card prompts you, you will be able to choose PXE-boot (Example 4-3). Booting from the network has to be enabled in the BIOS.

Example 4-3   Booting from the network

```
Broadcom UNDI, PXE-2.1 (build 082) v2.2.10
Copyright (C) 2000-2002 Broadcom Corporation
Copyright (C) 1997-2000 Intel Corporation
All rights reserved.

CLIENT MAC ADDR: 00 09 6B 00 12 60 GUID: 82A30F31-48B4-4A12-A86E-30C4F887C967
PXE-E51: No DHCP or proxyDHCP offers were received.


PXE-MOF: Exiting Broadcom PXE ROM.

Broadcom UNDI, PXE-2.1 (build 082) v2.2.10
Copyright (C) 2000-2002 Broadcom Corporation
Copyright (C) 1997-2000 Intel Corporation
All rights reserved.

CLIENT MAC ADDR: 00 09 6B 00 12 61 GUID: 82A30F31-48B4-4A12-A86E-30C4F887C967
CLIENT IP: 9.1.1.16  MASK: 255.0.0.0  DHCP IP: 9.1.1.1
GATEWAY IP: 9.1.1.11

Press F12 for network service boot
```

20.Choose the operating system you want to transfer to the server, if several RIS images have been created.

21.Enter the information about user ID, password, and domain.

22.A warning will be displayed indicating that you are about to delete everything on drive 1.

4.2.3 Remote Deployment Manager (RDM)

RDM is a manageability tool that runs on your IBM xSeries server. This beneficial tool simplifies and automates the deployment, redeployment, lower-level management, and disposal of xSeries servers. RDM uses imaging technology from industry-leader PowerQuest to provide high-performance cloning, recovery, and re-provisioning solutions.

Because Remote Deployment Manager gains control of a PC before it starts its local operating system, many of the lower-level tasks that previously required a visit to each computer can now be performed over the network. Using Remote Deployment Manager, a network administrator can remotely flash a selected system's BIOS, modify CMOS settings, perform automated installation of Microsoft Windows 2000, and backup and recover the primary partition.

Remote Deployment Manager will save the user time from running around from system to system. It helps make systems management simpler and less time-consuming.

When imaging a Windows 2000 Server, you need to consider the following:

► Which components will be deployed to the Windows 2000 Server?
► What tool will be utilized to image the server?
► What tool will be used to generate a new SID?

We utilized RDM to capture an image and then deploy the image to a blade server. The steps are outlined in the following sections.

Note: We disabled the RIS service to allow RDM to PXE boot the servers.

Capture an image

The following process is used to capture an image of a server:

1. From the server that is having the image captured, create a sysprep directory and copy sysprep.exe and setupcl.exe. These files were extracted from the support/tools/deploy.cab file located on the Windows 2000 Server CD.

2. From the RDM console, click **Start**.

3. Run the sysprep.exe from the server that is being imaged. The server will reboot. It must boot from the network adapter.

4. When the server has been recognized in RDM, it will appear in the unassigned systems section. Click **Stop**.

5. Drag and drop the server onto the Deploy Center in the Profiles and assigned systems section.

6. Enter the name of the profile and the type of operation system, and then click **Next**.
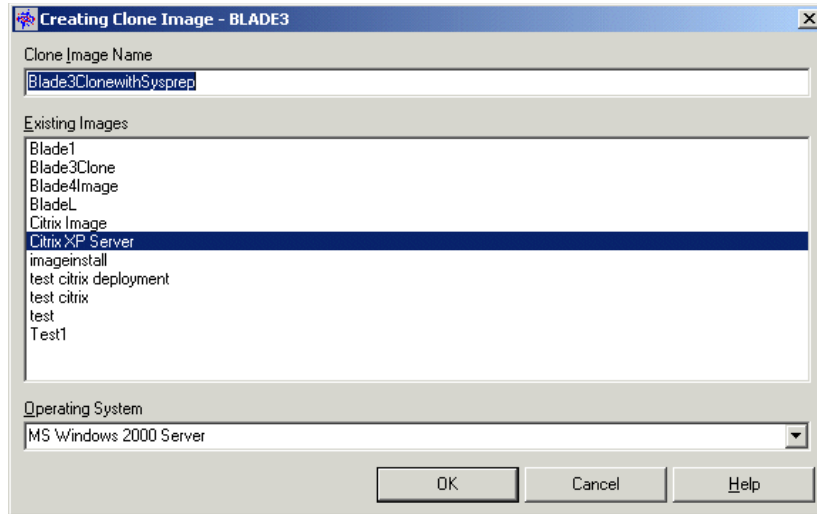
Figure 4-4   Creating clone profile

7. Click **Process** on the RDM console.

8. Reboot the server that is to be imaged.

9. A screen similar to Figure 4-5 will be displayed when the image is being captured.

Figure 4-5   Imaging server window

Deploy the image

In this section, this process is used to deploy an image to a server. Perform the following instructions:

1. From the RDM console, select **Profile** and create a new profile.
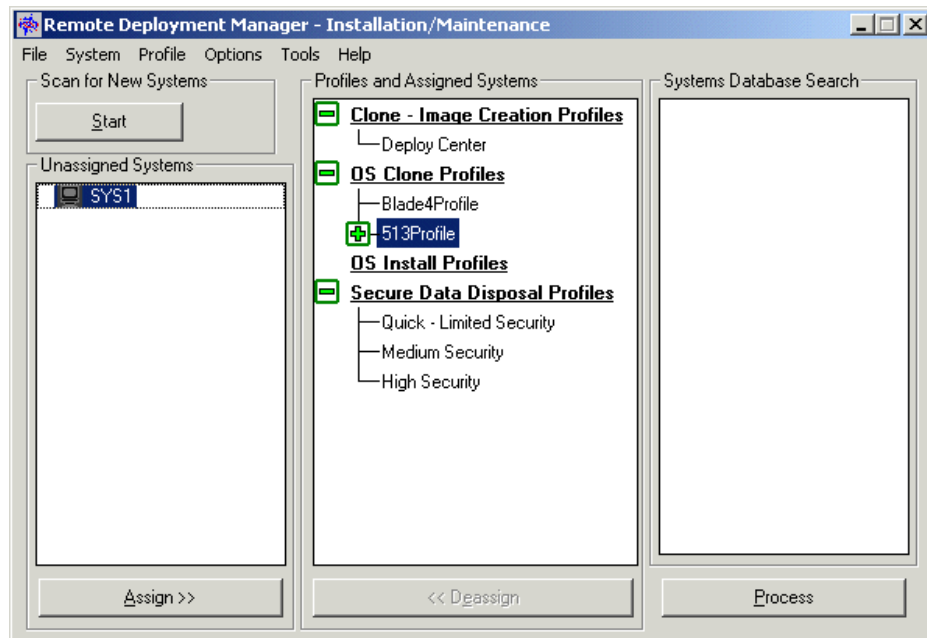
Figure 4-6   RDM Console

2. Create a new profile.

Figure 4-7   Create New Profile window

3. Select **Use the Profile Wizard** and click **OK.**
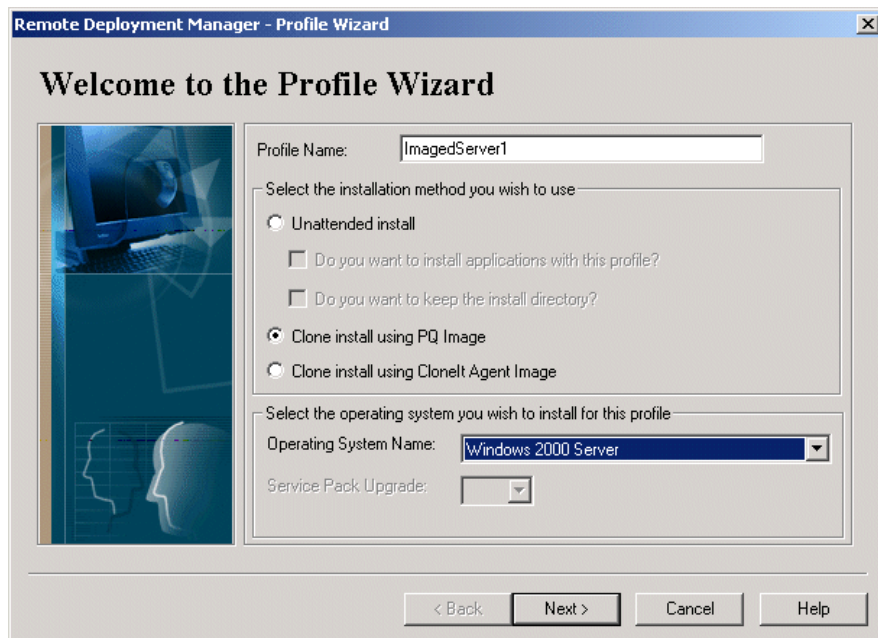
Figure 4-8   Profile Wizard

4. Enter the name of the Profile, select **Clone install using PQ image**, specify the operating system name, and then click **Next**.

5. Select the image that was created earlier, and then click **Next**.

6. There is no Raid adapter, so click **Next**.

7. We did not install the power restore partition, so click **Next.**
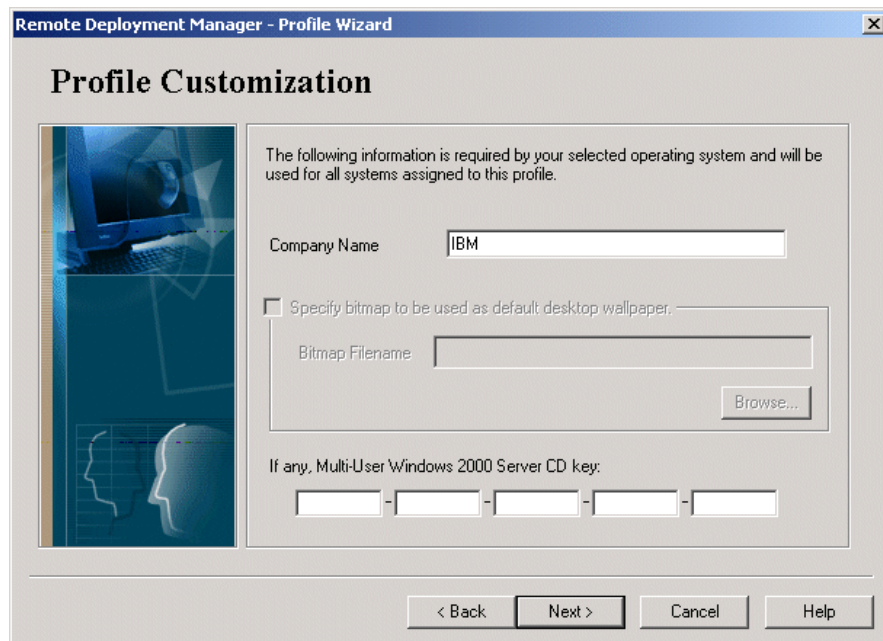
Figure 4-9   CD license key

8. Enter the company name and the Windows 2000 Server CD key, and click **Next**.

9. Enter the region setting, and click **Next**.
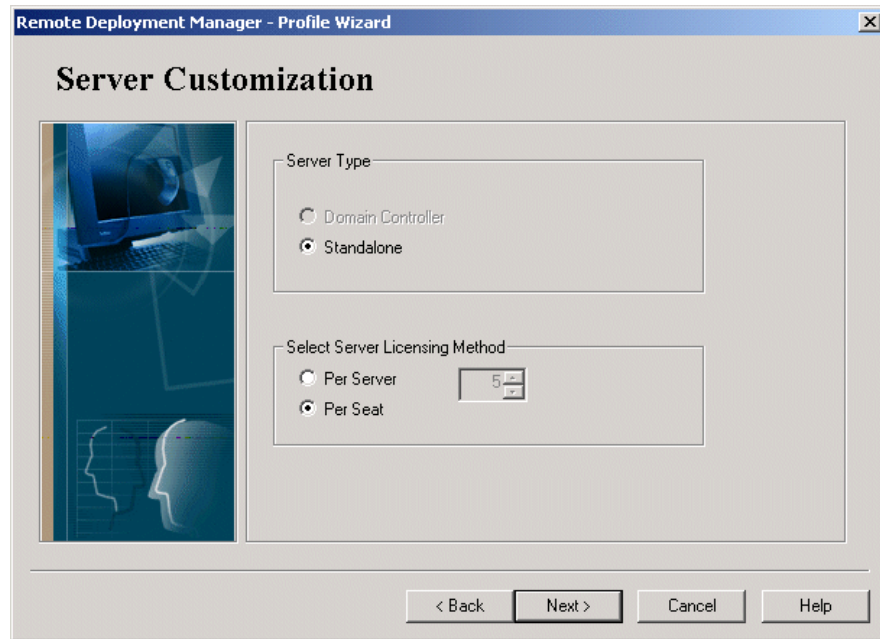
Figure 4-10   Server Customization window

10. In the Server Type section, we selected **Standalone**. For the Server Licensing method, select **Per Seat** and click **Next**.
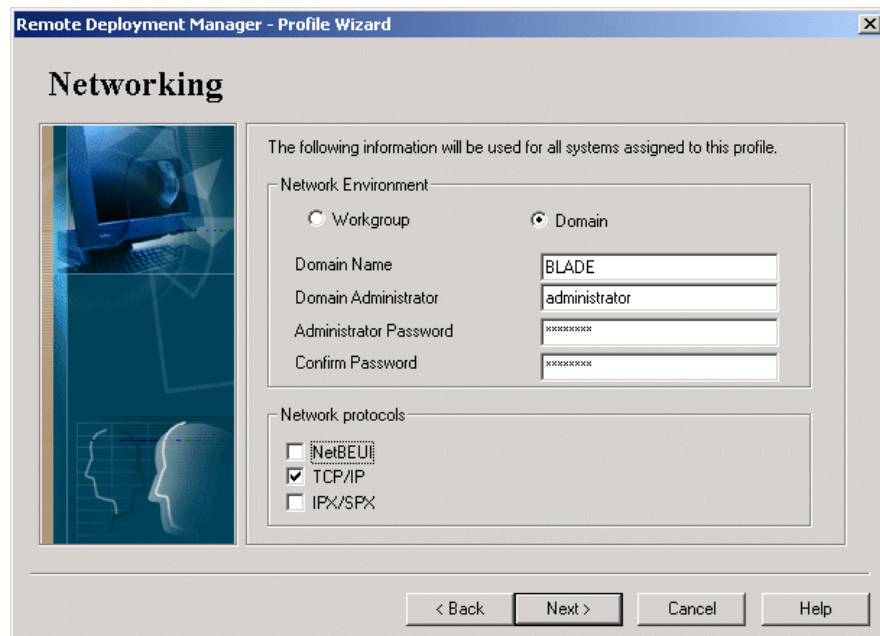
Figure 4-11   Domain and protocol details

11. Specify if the server will belong to a domain or a workgroup. In our example, we selected **Domain** and typed BLADE in the Domain Name field. In the Domain Administrator field, we typed administrator. Specify the protocol; in our example, we selected **TCP/IP**. Click **Next**.

12.We specified TCP/IP to use DHCP and clicked **Next**.
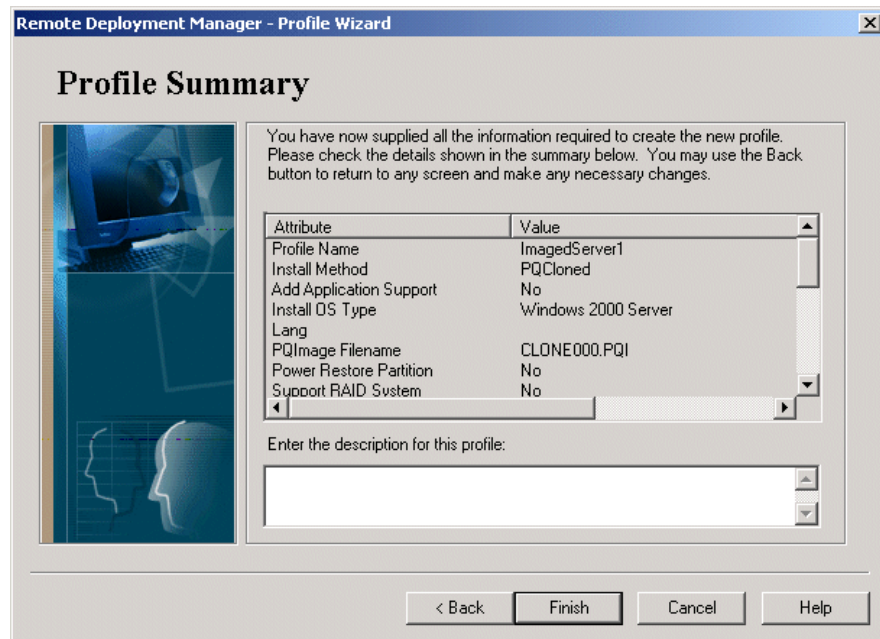
Figure 4-12   Profile Summary

13.Enter a description of the profile and click **Finish**.

14.Drag and drop the server to the new profile and click **Next**.
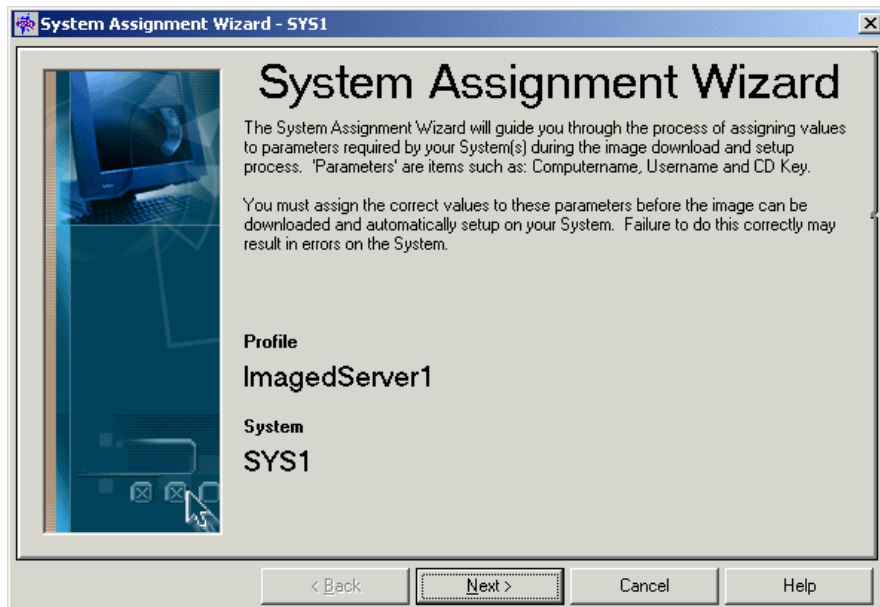
Figure 4-13   System Assignment wizard

15.We did not add any custom values; therefore, click **Next**.
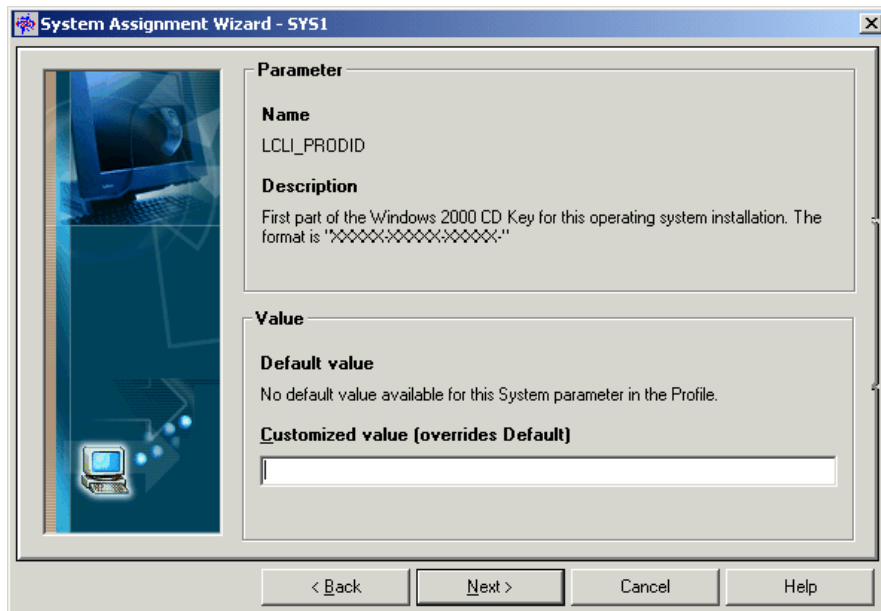
Figure 4-14   License key

16. Enter the first section of the license key, and then click **Next**.
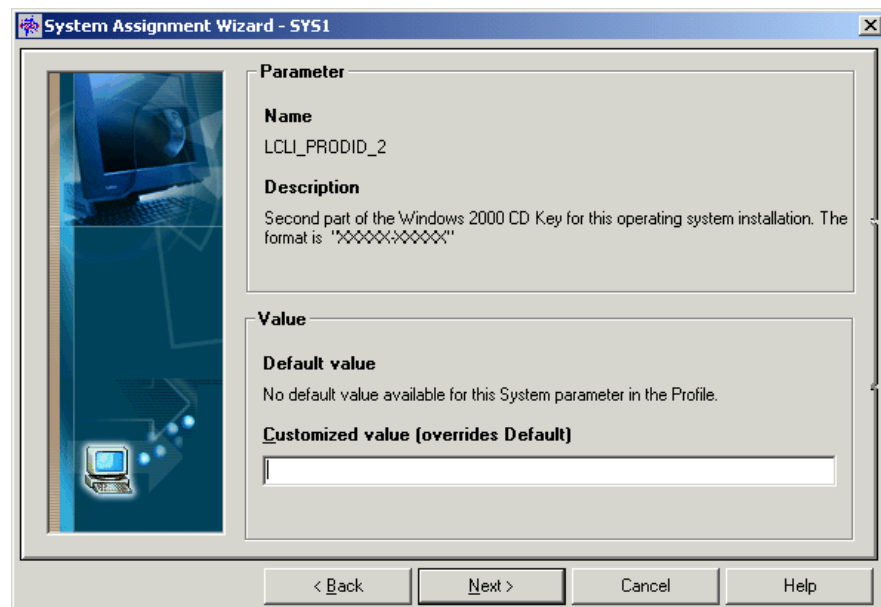
Figure 4-15   Section half of the license key

17. Enter the second section of the license key, and then click **Next.**

18. Click **Next**.

19. Click **Next**.
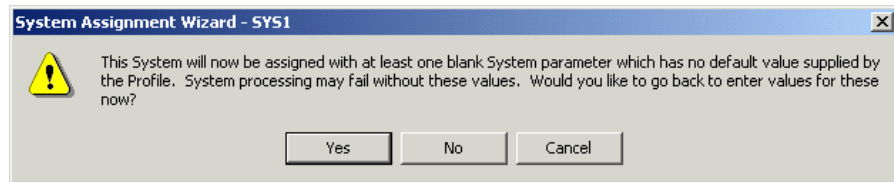
Figure 4-16   System assignment wizard

20. Click **No**.

f
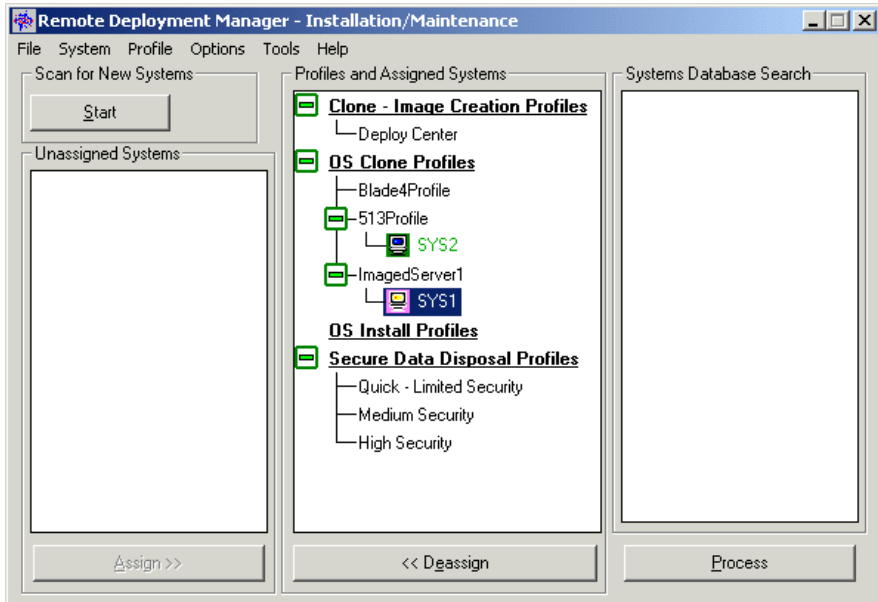
Figure 4-17   Executing the deployment

21. Click **Process**.

22. On the Server that is receiving the image, you will see a window similar to Figure 4-18 on page 44.

```
Broadcom UNDI, PXE-2.1 (build 082)v2.2.10
Copyright (C) 2000-2002 Broadcom Corporation
Copyright (C) 1997-2000 Intel Corporation
All rights reserved.

CLIENT MAC ADDR: 00 09 6B 00 12 7D  GUID: 163AE2D8-FA1D-B211-829B-20BEF58548A6
PXE-E51: No DHCP or proxyDHCP offers were received.


PXE-MOF: Exiting Broadcom PXE ROM.

Broadcom UNDI, PXE-2.1 (build 002) v2.2.10
Copyright (C) 2000-2002 Broadcom Corporation
Copyright (C) 1997-2000 Intel Corporation
All rights reserved.

CLIENT MAC ADDR: 00 09 6B 00 12 7F  GUID: 163AE2D8-FA1D-B211-829B-20BEF58548A6
CLIENT IP: 9.1.1.17  MASK: 255.0.0.0
DHCP IP: 9.1.1.1  PROXY IP: 9.1.1.11
GATEWAY IP: 9.1.1.11

Auto-select:
     Remote Deployment Manager
UD 9.1.1.11.\
```

Figure 4-18   Imaging deploying

4.3 Modifying the installation to incorporate network drivers

The Broadcom Gigabit Ethernet adapter is not included on the Windows 2000 installation, which means that the installed server will result in having two unknown devices, one for each network interface. To avoid this, you need to modify the installation file risstndrd.sif in the RIS installation.

4.3.1 RIS-based installation

Below are the steps we followed to update the Windows 2000 Service Pack 3 RIS installation with the Broadcom drivers included.

1. Download and unpack the Broadcom driver from the IBM Web site.

2. Copy the *.inf and *.sys from the unpacked Broadcom driver directory to the d:\remoteinstall\setup\english\win2000.adv\i386 directory.

3. Modify the [unattended] section of risstndrd.sif located in d:\remoteinstall\setup\enlish\win2000.adv\i386\templates:

   – add line: OemPreinstall = no

   – add line: OemPnpDriversPath = "\pnpdrvs"

4. Copy all the information from the unpacked Broadcom directory to d:\remoteinstall\setup\english\win2000.adv\$oem$\$1\pnpdrvs.

5. Restart the RIS-server by starting a command prompt. Click **Start -> Run** and type cmd in the window. Click **OK -> Run**.

6. Next, execute the following commands (See Example 4-2 on page 35).

```
net stop binlsvc
net start binlsvc
```

4.4 Other hardware considerations

The blade servers can be fitted with either a SCSI adapter or a Fibre Channel adapter. The SCSI adapter is a LSI 53C1020 SCSI controller and the Fibre Channel card is a Qlogic 2300 HBA. You will need drivers for these adapters when you install the operating system. Download them from the IBM Web site: http://www.pc.ibm.com/support. If these drivers are not available at the previous site, go to:

Fibre Channel card: http://www.qlogic.com/support/drivers_software.asp

LSI SCSI card: http://www.lsilogic.com/support/index.html

4.5 IBM eServer™ BladeCenter in different scenarios

This chapter will cover configurations in the following scenarios.

► Hot-spare blade
► Web farm
► Citrix farm
► Development environments

4.5.1 Hot-spare blade

Within an IBM @server BladeCenter, you are able to have a hot-spare blade server which operates in the same fashion as the hot-spare drive in a RAID array. If one blade server fails, you can easily deploy the function of that blade server to the hot-spare, through either RDM, RIS, new install or from backup.

4.5.2 Web farm

The IBM @server BladeCenter is the ideal environment to house a Web farm either with a piece hardware or software to perform load-balancing across the farm.

The Web farm could be running some sort of load-balancing software, for example, IIS servers running WLBS (Windows Load Balancing Service) to distribute the load across the farm or a similar application for an IBM Web server or Apache. Another option would be to run some kind of DNS round-robin solution to distribute the load across the IBM @server BladeCenter.

4.5.3 Citrix farm

A Citrix farm on the IBM @server BladeCenter is an excellent way to present applications to the user via inexpensive, high density computers.

The customer wants to install Windows 2000 and Citrix MetaFrame XP for 100 users. There is an existing Windows 2000 Active Directory, utilizing TCP/IP, DHCP and DNS for all clients and servers on a 10/100 Mbps Ethernet network. The clients are a combination of Windows NT 4, Windows 2000 and Windows XP Professional.

The clients will have the ICA client deployed to the desktop and there will be 24 applications published to the users. The applications are a combination on 16 bit and 32 bit.

There will only be applications stored on the Citrix servers, all other data will be stored on existing file servers. An existing IBM Director server will manage the BladeCenter unit, which utilizes an Microsoft Access database.

The Citrix MetaFrame farm will have the following configuration:

► All servers will be of the same hardware and software configuration
► Four IBM @server BladeCenter HS20 servers for the Citrix MetaFrame servers
  – Single 2.4 GHz Xeon processors
  – 2.5 GB of memory
  – 2 * 40GB EIDE disk drives
  – 1 IBM @server BladeCenter to house the blade servers
  – Windows 2000 SP3
  – XP Feature Release 2
  – Operating systems and applications on drive 0
  – Swap file and printer spooler on drive 1
► A single zone
► There will be two server groups, two servers per group
► 16 bit applications will have resources limited to them

Microsoft Access is utilized for the Citrix Farm.

4.5.4 Development environments

Using the IBM @server BladeCenter in a development situation is efficient when a company has several ongoing projects or several versions of applications. The developers can allocate the amount of blades they need for the development and testing of their applications.

For example, team one needs a Web server, an application server and a database server. Team two needs several Web servers for an application that requires load-balancing. On an external management system running IBM director and RDM, you can easily deploy already prepared installations of the different server, either it might be Windows 2000 or Linux.

5

A brief introduction to Layer 4-7 Switching

This chapter provides a brief overview of how Layer 4-7 Switching works. The goals are to present an alternative to traditional network design and to provide enough background to understand how a Layer 2-7 switch can be beneficial to a network. While this chapter gives a brief overview of the features and benefits of Layer 4-7 Switching, it also mentions the Layer 2-7 GbE Switch Module or GbESM. For a more in-depth look at Layer 4-7 Switching, refer to the *IBM @server BladeCenter Layer 2-7 Network Switching* REDP3755.

5.1 Layer 4-7 Switching

Most networks employ multiple servers without server load balancing. Each server usually specializes in providing one or two unique services. However, a server that provides applications or data in high demand can become overutilized. If this happens, it can strain network resources since when the server starts rejecting user requests, the users resubmit the requests for data.This often happens on networks where several other servers are sitting idle with resources available to service users.

Layer 4-7 Switching can harness these available idle servers without additional special equipment such as dedicated load-balancing servers. The term L4-7 is used because these switches are Layer 4 (TCP) aware. These switches use headers and data found at the OSI Layer 7 to deliver many of their key features. Layer 2 and Layer 3 switches operate on and are aware of Layers 2-3 only.

Layer 4-7 Switching can be used to improve the reliability, scalability, and performance of a wide variety of applications and services. Layer 4-7 isolates the delivery of a service, from a user's point of view, from the physical reality of how that service is delivered. A Layer 4-7 switch is aware of the services provided by each server. Based on several load-balancing algorithms, a switch can direct user session traffic to an appropriate server. This means that in addition to using the available resources on otherwise idle servers, resources can be provisioned "on the fly". This lets network administrators add or subtract to the service delivery capability to react to server failures, meet demands during peak periods and scale back resources once demand is over. All of this happens with no knowledge or participation from the users of that service.

To take advantage of L4-7 Switching, services or applications advertise themselves using normal hostnames such as www.ibm.com® to the outside world. However, DNS resolution will resolve that hostname back to a Virtual IP Address(V_IP) assigned to an L4-7 switch. A service advertised by a V_IP is a Virtual Service. When application requests are sent from users to a V_IP, the L4-7 switch forwards the request to one or more real servers with real IP addresses.

The collection of real servers to which a request for a particular Virtual Service can be sent is called the Virtual Service Pool. By adding real servers to a Virtual Service Pool, the total application delivery throughput can be increased and application delivery times reduced. By moving real servers between Virtual Service Pools, shifting loads and demands between services can be met without having to provision enough servers for each application to meet the peak demands (which would result in several unused servers in off-peak times).
Figure 5-1 on page 49 shows how the Layer 2-7 GbE Switch Module installed in BladeCenter could be used to redeploy blades to service a few different applications according to demand.
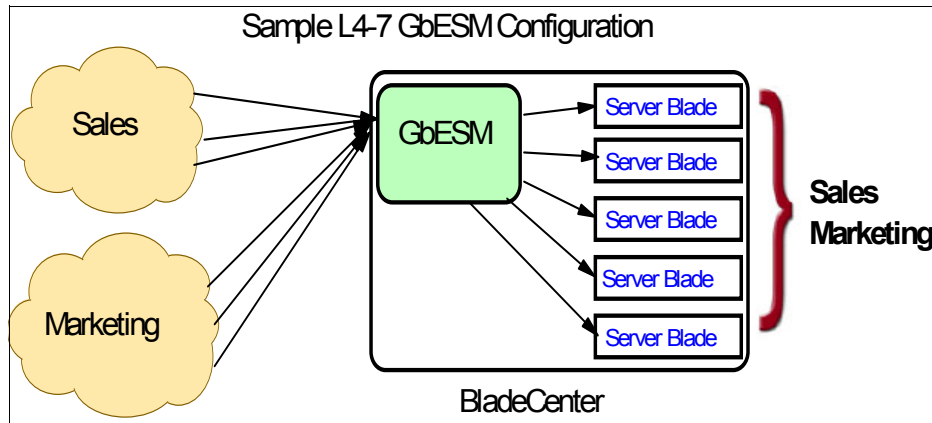
Figure 5-1   Sample L4-7 configuration.

Figure 5-1 shows how services can be deployed using Layer 4-7 Switching. Using the GbESM in the BladeCenter, all server resources can be configured to support all applications, with the GbESM spreading the load among them at all times. As the loads on Sales and Marketing vary throughout the day or week or month, resources are automatically allocated in real time to meet the need.

In this scenario, to provide load balancing for any particular type of service, each server blade in the pool must have access to identical content, either directly (duplicated on each server) or through a back-end network (mounting the same file system or database server).

The GbESM acts as a front end to the servers, interpreting user session requests and distributing them among the available servers. Load balancing in the GbESM can be done in the following ways.

Virtual server-based load balancing

This is the traditional load-balancing method. The switch is configured to act as a virtual server and is given a V_IP for each service it will distribute. Each virtual server is assigned a list of the IP addresses (or range of addresses) of the real servers in the pool where its services reside. When the user stations request connections to a service, they will communicate with a virtual server on the switch. When the switch receives the request, it binds the session to the IP address of the best available real server and remaps the fields in each frame from virtual addresses to real addresses. HTTP, IP, FTP, RTSP, IDS, and static session WAP are examples of some of the services that use virtual servers for load balancing.

Filter-based load balancing

A filter allows you to control the types of traffic permitted through the switch. Filters are configured to allow, deny, or redirect traffic according to the IP address, protocol, or Layer 4 port criteria. In filter-based load balancing, a filter is used to redirect traffic to a real server group. If the group is configured with more than one real server entry, redirected traffic is load balanced among the available real servers in the group. Firewalls, WAP with RADIUS snooping, IDS, and WAN links use redirection filters to load balance traffic.

Content-based load balancing

Content-based load balancing uses Layer 7 application data (such as URL, cookies, and Host Headers) to make intelligent load balancing decisions. URL-based load balancing, browser-smart load balancing, and cookie-based preferential load balancing are a few examples of content-based load balancing.

In the example in Figure 5-1 on page 49, virtual server load balancing is used. The switch has two different V_IPs configured which correspond to each of the services (Sales and Marketing). DNS responds with these V_IPs when these services are requested. The GbESM is also configured for the real IP addresses (R_IPs) that are owned by blades that support requests coming into each V_IP. In this case, all server blades can respond to requests for all services, so each V_IP is assigned the entire set of R_IPs.

A TCP connection consists of a series of packets sent back and forth from two destinations. If packets are misrouted and sent to the wrong destination, the session will slow down due to retransmissions and possibly fail if misrouting continues. Therefore, a Layer 4-7 switch needs to be TCP-aware in the sense that it needs to be able to:

► Identify the beginning of a new TCP connection
► Assign that connection to a real server
► Make sure that all ensuing packets related to that TCP connection continue to be sent to the same real server

This requirement is what puts the "Layer 4" in L4-7. The GbESM provides this capability. All packets arriving that are destined to a V_IP are inspected to determine whether they are associated with an existing TCP connection (in which case they are re-directed to the real server already assigned) or whether they are a request to set up a new TCP connection. If the received packet is a request to establish a new TCP connection (a TCP SYN packet), the GbESM will determine the best available server to re-direct that request to and then do so. The "best available" consideration can be made based upon a number of factors that are beyond the scope of this chapter. It is enough to say that "best available" is based on a consideration of the present health and load of each of the candidate real servers.

This chapter introduces the concepts of Layer 4-7 Switching and how it benefits customers deploying applications on the IBM @server BladeCenter. For a more in-depth look at Layer 4-7 Switching, refer to *IBM @server BladeCenter Layer 2-7 Network Switching*, REDP3755. In addition to expanding on the concepts discussed here, this Redpaper is an excellent guide to deploying the GbESM in both Nortel and Cisco networking environments.

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this Redpaper.

IBM Redbooks

For information on ordering these publications, see "How to get IBM Redbooks" on page 52.

- *IBM @server BladeCenter Systems Management,* REDP3582
- *Deploying Citrix MetaFrame on IBM @server BladeCenter,* REDP3583
- *Deploying Lotus Domino on IBM @server BladeCenter,* REDP3584
- *Deploying Microsoft Exchange on IBM @server BladeCenter,* REDP3585
- *IBM @server BladeCenter Layer 2-7 Network Switching*, REDP3755

Referenced Web sites

These Web sites are also relevant as further information sources:

- IBM sites

  http://www.pc.ibm.com/us/eserver/xseries/bladecenter_family.html- Main support

- Citrix

  Main support:

  http://www.citrix.com

  Advanced Concepts MetaFrame XP for Windows with Feature Release 2:

  http://www.citrix.com/products/metaframexp.asp

  Planning your MetaFrame deployment:

  http://download2.citrix.com/ctxlibrary/products/pdf/xp_deployment_whitepaper.PDF

- Microsoft

  Main support:

  http://www.microsoft.com

  Terminal Services:

  http://www.microsoft.com/windows2000/technologies/terminal/default.asp

- DABCC.COM

  NFuse and Project in a Box:

  http://www.dabcc.com

- IBM ServerProven

  http://www.ibm.com/pc/compat/

- IBM @server BladeCenter - Power Module Upgrade Guidelines

  http://www-1.ibm.com/support/docview.wss?uid=psg1MIGR-53353

- IBM @server BladeCenter - Power Module Upgrade Guidelines

  ftp://ftp.software.ibm.com/pc/pccbbs/pc_servers_pdf/13n0308.pdf

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The Cutting Edge:
IBM *e*server BladeCenter

Redpaper

Learn what's hot about IBM *e*server BladeCenter

Explore the advantages of IBM *e*server BladeCenter

Install and configure Windows 2000 Server

In this IBM Redpaper, we provide an introduction to the IBM *e*server BladeCenter. This introduction includes an overview of the BladeCenter technology and hardware for the chassis and the blades. In addition, we take a look at blade management and the options that are currently available.

This Redpaper presents the advantages of blade servers over other servers in the market and explains where the blade servers fit into the market and why the market is driven towards blade servers. We also look at the various installation methods that are available and what important considerations should be included before you perform your installation. Several installation examples are provided using Windows 2000 with CD-ROM, RIS and RDM.

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